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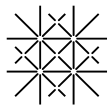
# Giving = Receiving? The outcome of prosocial behavior within and between clinical and non-clinical individuals, and couples.

Inaugural Dissertation submitted in fulfillment of the requirements for the degree of Doctor of Philosophy to the Department of Psychology of the University of Basel by

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from Wissembourg, France

Basel, 2019



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Approved by the Department of Psychology at the request of

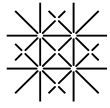
Prof. Dr. Andrew Gloster

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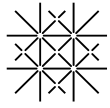
## Declaration of Authorship

I, Marcia Theresa Bérénice Rinner (born March 25, 1992), hereby declare that I have contributed independently and substantially to this dissertation without any assistance from third parties who are not indicated. I have used only the resources indicated and have cited all references. Published manuscripts or manuscripts submitted for publication were prepared in cooperation with coauthors and have not been submitted elsewhere for review or consideration, nor have they been published elsewhere. This dissertation includes the following three manuscripts:

- Rinner, M. T. B, Meyer, A. H., Mikoteit, T., Hoyer, J., Imboden, C., Hatzinger, M., Bader, K., Lieb, R. Miché, M., Wersebe, H., Gloster, A. T. (2019). General or Specific? The Memory Experience Gap for individuals diagnosed with a major depressive disorder or a special phobia diagnosis, and individuals without such diagnoses. *Memory*, 1-10.
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- Rinner, M. T. B, Meyer, A. H., Gloster, A. T. (paper submitted for peer review). Giving is receiving? What influences the relation between prosocial behavior and well-being?

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## **Abbreviations**

|        |  |
|--------|--|
| ACT    | Acceptance and Commitment Therapy  |
| DSM-IV | Diagnostic and Statistical Manual of Mental Disorders, 4 <sup>th</sup> edition |
| ESM    | Event Sampling Methodology   |
| GLMM   | General Linear Mixed-effect Model  |
| LMM    | Linear Mixed-effect Model  |
| MDD    | Major Depressive Disorder  |
| MeG    | Memory-Experience Gap  |
| PB     | Prosocial Behavior   |
| PhD    | Doctor of Philosophy   |
| SCID   | Structured Clinical Interview  |
| SP     | Social Phobia  |

Abstract

The literature on the effects of prosocial behavior (PB) on well-being shows mixed results, reporting costs and benefits from PB. A better understanding of if, when, how and from whom acting prosocially is beneficial could be important to improve individuals well-being. The aim of this dissertation was to assess the relation between PB and well-being, and the frequency of PB within several populations, while using assessment tools known to reduce memory biases. Several biases have been reported in the literature within different populations. Specifically, Memory-Experience Gaps (MeGs) were found within clinical and non-clinical population, separately. A further aim of this dissertation was to assess MeGs between several populations. Furthermore, two factors were assessed that are also believed to interact with the relation between PB and well-being (closeness to the recipient of the PB, and feeling of choice of the prosocial actor). Two samples (n = 284 and n= 180), one including individuals diagnosed with major depressive disorder (MDD) or social phobia (SP), and individuals in a control group without a diagnosis of MDD and SP, and another sample including couples were investigated. Event sampling methodology (ESM), a method known to reduce memory biases was hereby mainly used to assess the study variables with the exception of the assessment of the MeG, for which retrospective variables were compared with ESM variables. Results show that individuals diagnosed with MDD and SP and individuals in a control group tend to retrospectively overestimate experiences that are most salient to them (e.g. sadness for MDD). Results also suggest that when PB is assessed using ESM, PB was positively related to the well-being within individuals in the MDD, SP and control group. This finding did not last over time and could not be replicated for couples. Furthermore, closeness to the recipient of PB and choice have been shown to related with well-being. These results give important information on the relation between PB and well-being. Implementation and future directions of PB for research and practice are discussed.

## Introduction

Psychological disorders are highly prevalent and are related with high burden (Wittchen et al., 2011). Those findings underline the need to develop therapies and programs that increase well-being and reduce psychopathologies. Despite several validated therapies (Division 12 of the American Psychological Association, 2016) between 30% and 40% of the patients are estimated to not respond to therapy (Gloster et al., under review.; Souery, Papakostas, & Trivedi, 2006; Taylor, Abramowitz, & McKay, 2012; Westen & Morrison, 2001).

New empirical evidence is needed to reduce psychopathologies and increase well-being. As such, it is important to increase the understanding of potential risk factors for psychopathologies (Asselmann, Wittchen, Lieb, & Beesdo-Baum, 2016; Steinhausen, Jakobsen, Meyer, Munk-Jørgensen, & Lieb, 2016), and to develop effective prevention programs (Nation et al., 2003). Furthermore, it is important to understand factors that are protective and boost wellbeing. Health, exercise, employment and social contacts, for example, are factors found to be positively associated with well-being (Dolan, Peasgood, & White, 2008). However, the relation between those factors and well-being is complex and does not always follow the rule “the more the better”. For example, being employed seems to be better than being unemployed (Helliwell, 2003), but working too many hours has been related to less well-being (Härmä, 2003). In line with this, being in a relationship seems to be better than being alone (Dolan et al., 2008), but being in a position of care giver for a partner or other close individuals is related to less wellbeing (Hirst, 2005). Especially, in the literature of prosocial behavior (PB), which includes behaviors such as caring for someone, mixed results have been reported. On the one hand, studies found positive relations between PB and well-being (Thoits & Hewitt, 2001; von Bonsdorff & Rantanen, 2010), on the other hand, negative relations between PB and well-being have also been found (Fredman, Cauley, Hochberg, Ensrud, & Doros, 2010; Pavalko & Woodbury, 2000). Studies analyzing potential factors that are associated with well-being when acting prosocially are needed, and that therapies and programs are developed based on those.

The aim of this dissertation was to assess the relation between PB and well-being for different populations, and assessing factors that are believed to impact this relation (e.g. closeness to the recipient of PB and choice). A further aim of this dissertation was to compare the MemoryExperience Gap (MeG), a type of memory bias, between different populations. To then implement those results in the assessment of PB also for different populations.

## **Theoretical Background**

### **Prosocial behavior (PB)**

PB represents an umbrella term that encompasses a broad range of acts undertaken to protect or increase the benefit of other individuals (Bilsky & Schwartz, Shalom, 1990; Penner, Dovidio, Piliavin, & Schroeder, 2005), such as helping others, acting kindly, volunteering, and donating (Weinstein & Ryan, 2010). Human beings are prosocial beings, and acting prosocially has an evolutionary advantage (Penner et al., 2005). In line with this evolutionary view of PB it has been claimed that individuals behave in a prosocial manner to avoid punishment (Fehr & Fischbacher, 2003). This might be why human beings show PB at a very young age, as young as 18 months (Warneken & Tomasello, 2006).

### **Benefits or costs from PB?**

Next to the evolutionary advantages, PB is related to several physiological and psychological benefits. PBs are related to reduced morbidity (Brown, Consedine, & Magai, 2005), and have been linked to reduced systolic and diastolic blood pressure and mean arterial pressure (Piferi & Lawler, 2006). PBs are also related to increased life satisfaction (von Bonsdorff & Rantanen, 2010), self-esteem (Piferi & Lawler, 2006), self-worth (Gruenewald, Liao, & Seeman, 2012) and increased affect (Aknin et al., 2010; Nelson, Layous, Cole, & Lyubomirsky, 2016). These effects are possibly due to an induced feeling of purpose in life

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(Musick & Wilson, 2003) and an increased feeling of social connectedness when showing PB (Padilla-Walker & Carlo, 2014). These findings suggest that PB benefits the actor of PB, however it may not be beneficial for every population, in every context. In line with this claim, further data also showed costs from PB (Pavalko & Woodbury, 2000; Schulz & Sherwood, 2008). For example, PB has been shown to increase psychological distress (Fredman et al., 2010; Hirst, 2005), is related to higher symptoms of depression, specifically for heavy care givers (Burton, Zdaniuk, Schulz, Jackson, & Hirsch, 2003), and is related to a higher risk of mortality (Schulz & Beach, 1999). It has been claimed that PB can be costly for the actor because it consumes valuable attentional and regulatory resources, which otherwise could have been used by the actor (Lanaj, Johnson, & Wang, 2016). In sum, previous studies report both benefits and costs from PB. It remains unclear whether, when, and for whom PB is beneficial or costly.

### **Which factors might influence the outcomes of PB?**

**Group differences.** Different populations might benefit or react differently to PB and might therefore show differing outcomes when acting prosocially. For example, a study that compared consequences of PB in a younger and older adult population reported population-based differences (Musick & Wilson, 2003). Older individuals showed lower levels of depression compared to younger individuals when acting prosocially. Derived from this study one might expect that older individuals with a diagnosis of depression would show less PB. This conclusion however remains hypothetical, as a non-clinical population was investigated (Musick & Wilson, 2003) and the results can therefore not be generalized to a clinical population. The frequency of PB might differ between clinical compared to non-clinical populations. When PB was assessed comparing a clinical to a non-clinical population using economic games, mixed results were found (Alarcón & Forbes, 2017; Gradin et al., 2016). On the one hand, individuals diagnosed with major depressive disorder (MDD) acted comparably prosocial as individuals in the control group (Gradin et al., 2016). On the other hand, Alarcón and Forbes (2017) concluded that MDD

was associated with less PB in adults compared to control groups. Furthermore, the results of those games may not be generalizable as economic games are conducted within laboratories, an environment that differs from most everyday life natural environments (Levitt & List, 2007). Further studies are needed to compare potential differences in PB for clinical and non-clinical individuals in everyday life, especially for individuals with anxiety disorder or MDD, with those being within the most prevalent mental disorders (Wittchen et al., 2011). Several contradicting hypotheses have been formulated to how clinical individuals would differ in their PB compared to non-clinical individuals in everyday life. Individuals with a diagnosis of MDD could potentially show more PB to relieve negative feelings compared to non-clinical individuals (Alarcón & Forbes, 2017). In line with this result a study from Culotta and Goldstein (2008) found that social anxiety is positively correlated with PB within young adolescents, which could mean that individuals with social anxiety show more PB. Contrary to those hypotheses, one could also expect that individuals with MDD show less PB due to a reduced ability to feel pleasure from prosocial acts (Alarcon et al. 2017). Also, individuals with social phobia (SP) might show less PB due to increased anxiety in social contexts (Beidel, Rao, Scharfstein, Wong, & Alfano, 2010). Additionally, clinical populations might also show less PB as a consequence of avoidant behavior and reduced positive reinforcement (Carvalho & Hopko, 2011).

In sum, different populations might show different outcomes when acting prosocially. Whether clinical and non-clinical population show different outcomes when acting prosocially within everyday life remains unclear. Studies are needed that compare PB between clinical and non-clinical population using instruments assessing experiences within everyday life and everyday relations.

**The Memory-Experience Gap (MeG) and why assessing PB in everyday life?** Using retrospective questionnaires to assess PB is probably prone to memory biases and using economic games does not represent an everyday life setting of PB (Levitt & List, 2007; Trull & EbnerPriemer, 2013). Several memory biases and MeGs have been reported in the literature.

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Memory biases is an umbrella term that includes all different memory distortions such as the MeG. MeG hereby represents discrepancies between a person's "real life" experience and the retrospective evaluation of that experience (Miron-Shatz, Stone, & Kahneman, 2009). It has been shown that humans across different populations tend to remember negative events better than positive events (Ganzach & Yaor, 2019; Kreitler & Kreitler, 1968). Additional to such an overall population representative MeG, studies have also reported biases that seem to be specific to a population. For example, participants diagnosed with MDD tend to recall more negative words during memory tests compared to participants in a control group (Joormann, Teachman, & Gotlib, 2009). In line with this negativity bias, recollection of positive affect, such as happiness, is retrospectively overestimated in a non-clinical population (Miron-Shatz et al., 2009; Tadic, Braam, VanVliet, & Veenhoven, 2013). Whether the experience of happiness is biased to the same extent for clinical populations has not been assessed yet. Similarly, to my knowledge, the MeG for diagnostic-specific stimuli in non-clinical populations has not been assessed yet. Clinical populations did show a MeG, by retrospectively overestimating diagnostic-specific stimuli, such as pain, panic attacks, binge episodes in eating disorders, and tobacco consumption (De Beurs, Lange, & Van Dyck, 1992; Margraf, Taylor, Ehlers, Roth, & Agras, 1987; Stein & Cortes, 2003; Stone, Broderick, Shiffman, & Schwartz, 2004). However, one study that assessed the MeG for obsessive-compulsive symptomatology did not find a MeG for obsessive-compulsive stimuli (Gloster et al., 2008). Potentially, depending on the stimuli (e.g. anxieties), different populations (e.g. clinical vs. non-clinical) show different MeG biases. As some stimuli might be related to a MeG that are general to all population, some other stimuli however might be related to MeGs that are specific to this population. Furthermore, the literature on the MeG differences between nonclinical individuals and individuals with anxiety disorder or MDD should specifically be assessed.

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Combining research on the MeG with the prosociality literature, if indeed clinical and non-clinical population show both MeGs for various stimuli, then assessing PB with retrospective instruments is probably also prone to memory biases. Therefore, studies are needed that assess PBs and their outcomes using measurements in everyday life, and reduce MeG.

***Methods to reduce the MeG.*** One method of choice used to reduce the MeG is the event sampling methodology (ESM; Gloster et al., 2008; Miron-Shatz et al., 2009; Trull & EbnerPriemer, 2013). This method is able to capture targeted emotions, cognitions, or experiences, as they occur during the exact moment of the survey and wherever the individual is in his or her environment, by using electronic devices such as smartphones. Questioning individuals about their experiences at the exact moment of the survey reduced the assessed time laps between the experience and the assessment and as such reduces the probability of memory biases (Houtveen & Oei, 2007). Only a few studies have used ESM for assessing PB. One of the few studies that assessed PB using ESM concluded that PB comes at a cost (feeling resources are depleted) for workers but replenishes resources when PB makes a positive and visible difference (Lanaj et al., 2016). Another study that used ESM within a community sample found a positive association between PB and well-being (Hui & Kogan, 2018). The different findings of both studies could be explained by different samples. Both studies failed to assess the mental health status of their participants. As reported previously, specific idiosyncrasies of a population might explain why PB is sometimes related to higher well-being while other times it is related to lower well-being. But further variables, such as closeness and choice might potentially also explain these two different study outcomes.

**Closeness.** One important aspect that needs to be considered to test the outcomes of PB is the relation between the actor (showing PB) and the recipient (profiting from the PB). In line with this, manipulating relation closeness (manipulated wish for a closer relation vs. distant relation) between actor and recipient has been shown to influence the outcome of PB



(Williamson &

Clark, 1992). The literature assessing PB in close relations mainly focused on care givers (e.g. a person taking care of his or her ill partner). Due to the physical and psychological distressing task of caring studies mainly found a negative relation between PB and well-being (Brown et al. 2015). However, when controlling for the care recipient's level of disability and caregiving time, a ESM study found increased positive affect (happiness, joy, pleasure, and enjoyment) within care givers (Poulin et al., 2010). Overall, close relationships are known to be crucial for individual health (Uchino, 2009). As such one could expect that well-being is increased when individuals act prosocially within close relationships compared to distant relationships.

**Feeling of choice.** According to the self-determination theory humans need a feeling of being in control over their actions (Deci & Ryan, 2000). A reduced feeling of control is hereby a risk factor for many psychopathologies (Keeton, Perry-Jenkins, & Sayer, 2008; Maes, Delmeire, Mylle, & Altamura, 2001; Moulding & Kyrios, 2007). In line with this, studies found that the positive outcome of PB was increased when the actor experienced a feeling of choice for his/her act (Sheldon, Boehm, & Lyubomirsky, 2013). Another study found a positive link between PB and well-being only when PB was experienced as a choice, but not when PB was nonchoiceful (Weinstein and Ryan, 2010). As such, when acting prosocially, one could also expect that wellbeing is increased when the actor feels having the choice to act prosocially.

In sum, studies are needed that assess the outcomes of PB within and between several populations and consider factors, such as closeness and feeling of choice, that might influence the relation between PB and well-being. Further, assessing potential populations specific or general MeG are important to better understand studies that retrospectively assessed PB and improve future assessments of PB by using assessment measuring PB in everyday life.

## **Research Questions**

The objective of this dissertation was to better understand the benefits and mechanisms of action of PB within several populations using ESM. The following three research questions guided the entire dissertation: 1) Are PB and well-being related to each other in several populations (clinical, non-clinical and couples)? 2) Do clinical and non-clinical populations differ regarding their MeG and PB frequencies? 3) Does closeness to the prosocial actor, and feeling of choice, impact the relation between PB and well-being? Specifically, the following hypotheses were addressed in three manuscripts which this dissertation encompasses (see Appendix A-C).

**Manuscript 1. General or Specific? The Memory-Experience Gap for individuals diagnosed with a major depressive disorder or a social phobia diagnosis, and individuals without such diagnoses.**

1) A MeG is present in all three groups (MDD, SP, and control) for experiences of sadness, social anxiety, happiness, and physical activity. 2) Participants in the control group differ with respect to the size of the MeG from participants in the MDD and in the SP group.

**Manuscript 2. Is helping you helping me? The assessment of helping others using eventsampling methodology in a clinical and a non-clinical sample.**

1) Individuals in the MDD or SP group would differ in their relative frequency of PB compared to individuals in the control group. 2) PB and well-being are related to each other over all study groups. 3) PB predicts subsequent well-being in all study groups, and well-being predicts subsequent PB in all study groups.

**Manuscript 3. Giving is receiving? What influences the relation between prosocial behavior and well-being?**

1) PB is related to higher well-being. 2) Well-being is increased when PB is provided to a close individual compared to a distant individual. 3) Well-being is increased when the actor acts prosocially by choice.

## **Method**

The research questions of this dissertation were analyzed using data of two different studies. Data presented in manuscript one and two are based on the study “Daily fluctuation of emotions and memories thereof” (Gloster et al., 2017), whereas data presented in manuscript three are based on the study “You & Me” (Gloster, Rinner, & Meyer, in prep.). Both studies were approved by a local or institutional ethical committee (EKNZ – 236-12; 001-15-2).

### **Participants**

**Manuscript 1 and 2. Daily fluctuation of emotions and memories thereof** (Gloster et al., 2017). Two hundred ninety participants took part in this study. Hereof, 118 participants met DSM-IV criteria for a diagnosis of MDD, 47 for SP and 119 participants did not meet either of the criteria. Patients were recruited from treatment centers (university clinics and cooperating local practitioners) in Switzerland and Germany, and participants in the control group were recruited through local advertisements. The three groups were matched for age and sex. Overall, participants were on average 32 years old ( $SD = 11.52$ ). The age of the participants ranged between 18 and 63 years, and 67% of the sample was female.

**Manuscript 3. You & Me** (Gloster, Rinner, & Meyer, in prep.). This study represents data from 90 couples (180 individuals) being in a relationship for at least six months. Participants were randomized into four groups. However, within this third manuscript only three groups were relevant, because group four did not receive smartphone assessments. To ensure a balanced age distribution within and between groups we used stratified randomization with two strata subdividing the sample in couples over and under 30 years of age on average. Participants were between 18 and 75 years old and on average 32 years old ( $SD = 12.24$ ). Fifty-one percent of the sample was female. Most couples were in a heterosexual relation (four couples being in a homosexual relation).

## Study design

**Manuscript 1 and 2. Daily fluctuation of emotions and memories thereof** (Gloster et al., 2017). All participants were invited to a baseline appointment at the university. After participants had given their informed consent, they completed demographic questionnaires and the Axis I diagnostic interview of the Structured Clinical Interview (SCID-I), which was based on DSM-IV and performed by trained PhD students. Depending on the diagnostic status of each participant, he or she was then assigned to one of the three study groups (MDD, SP, or control group). One week after the baseline assessment, participants were again invited to the university, and were instructed on how to answer questions on a smartphone device (ESM). Participants were then asked to answer questions on this device during the following 7 days contingent on an audible smartphone signal every 3 hours during each day (six prompts each day; e.g. 8 a.m., 11 a.m., 2 p.m., 5 p.m., 8 p.m., and 11 p.m.). Participants returned the smartphone one week later during a post assessment and retrospectively answered questions about this smartphone week (e.g. overall level of happiness).

**Manuscript 3. You & Me.** All eligible couples in this randomized controlled trial were randomly allocated to one of four study groups. Within this dissertation I only focused on three groups (group one, two and three). Group four was not included because participants did not receive smartphone assessments. The included three study groups differed with respect to the extent to which participants would receive a small Acceptance and Commitment Therapy (ACT) intervention. Each couple was invited to come in together for a baseline appointment. During this appointment participants gave written informed consent, and filled out questionnaires. Furthermore, in *group one* both individuals separately received a small ACT intervention and participants were instructed to practice ACT daily using a paper-pencil diary for a week. In *group two* only one individual of the couple received the small intervention and the diary. In *group three* neither of the individuals received the intervention or diary. All participants in group one, two, and three were asked to repeatedly answer questions on a smartphone device (ESM)

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between this first (baseline) appointment and a second (post) appointment. Identical to the first study, questions were prompted on this smartphone every three hours on an audible signal during waking hours for seven days. During a second appointment (post) participants gave back the device.

### Measures

With the exception of the retrospective assessment conducted during the post assessment all assessments used within this dissertation were collected using the weekly smartphone assessments (ESM) of both studies. Within the weekly smartphone assessment participants were asked to report happiness, sadness, anxiety, their physical activity, well-being and PB five times a day for 7 days. The formulation of each item originated from previous ESM studies (Brown, Strauman, Barrantes-Vidal, Silvia, & Kwapil, 2011; Gloster et al., 2008; Kashdan & Steger, 2006), validated questionnaires (Beck, Steer, & Brown, 1996; Bundesamt für Statistik, 2013), and self-developed items. All smartphone (ESM) items of both studies started with the wording “Since the last beep”.

**MeG.** The MeG was assessed within the study “Daily fluctuation of emotions and memories thereof” (first manuscript). MeGs for the experiences of sadness, social anxiety, happiness, and physical activity were hereby assessed. The experiences of sadness and social anxiety were chosen because they are characteristic to individuals with MDD, and SP. Furthermore, physical activity was chosen as an observable and countable experience, and happiness as a specific affect. Those experiences were once assessed retrospectively at post and within the smartphone assessment (ESM, i.e. between baseline and post). All items enquiring about sadness (“What percentage of the time did you feel sad?”), social anxiety (“What percentage of the time were you worried about what people think about you?”), and happiness (“What percentage of the time were you happy?”) ranged from “0” (never) to “100” (always). Physical activity was assessed during the smartphone week (“Have you engaged in a physical activity leading to sweating for at least 30 minutes?”, dichotomous, i.e. yes/no) and

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retrospectively (“How many days did you pursue a physical activity leading to sweating for at least 30 minutes?”, from “0 days” to “7 days”).

**PB.** In the second manuscript PB was assessed within the study “Daily fluctuation of emotions and memories thereof” by asking individuals to report if they helped someone, when they engaged in a meaningful social interaction “Did you help someone during this social interaction?”. In the third manuscript, PB was assessed within the study “You & Me” more broadly and not restricted to a specific social interaction: “Since the last prompt, have you either helped someone, took care of someone, supported someone, or did something for someone else?”. Answers to both items in both manuscripts were dichotomous (yes/no).

**Well-being.** In the second manuscript (study: “Daily fluctuation of emotions and memories thereof”) well-being was assessed based on items from the mental health questionnaire that can fluctuate over time (Keyes, 2009). As such, well-being was assessed by asking participants about their current level of happiness, satisfaction with life, endorsement of activities that helped the person grow, and feeling a sense of purpose. The four items were asked 5 times during awakening time and ranged from “0” (at no time or not at all) to “100” (all the time or throughout). In the third manuscript (study: “You & Me”) well-being was assessed by asking individuals on a scale ranging from “0” (not at all) to “100” (very much) how happy they felt.

**Closeness and Feeling of choice.** Closeness and choice were measured within the third manuscript (Study: “You & Me”). Closeness was measured by asking individuals to report “Who did you help?”. Participants had eight options to choose from (i.e. 1. Husband/Wife/Partner, 2. Child/ Children, 3. Other family member, 4. Friend, 5. Colleague, 6. Fellow students, 7. Medical staff, and 8. Other). Feeling of choice was assessed through the item “Why did you help someone?”. Participants were asked to indicate on a scale from “0” (not true) to “100” (very true) how much they agreed with statements representing choice ([1] ”I did it by choice”) or the opposite ([2] “I did it because I felt obligated”) in response to the item.

## Statistical analysis

All analyses were conducted using the statistical program R, version 3.3.2 and 3.5.0. (R Development Core, 2008)

**Research Question 1. Are PB and well-being related to each other in several populations?** In the second manuscript the relationship between PB and well-being was tested using both a Linear Mixed-effect Model (LMM) and General Linear Mixed-effect Model (GLMM), and a lagged GLMM and lagged LMM. Depending on the statistical prediction set in the model, well-being or PB was entered as an outcome, and PB or well-being, and time course as fixed effects, and random coefficients for intercept and time course. In further models, the interaction effect between PB and study groups was added to the previous models, to test whether the three study groups differed with respect to this interaction. In the third manuscript an LMM was constructed. This model included well-being as the outcome and PB as a fixed effect to statistically predict wellbeing. Further, by-subject variability was included as a random intercept and PB was entered as a random slope.

**Research Question 2.1. Do clinical and non-clinical populations differ with regard to their MeG?** To test the MeG for each group, separate LMMs or GLMMs were conducted for each study group and outcome (manuscript one). The models contained only a fixed intercept (subtracting the identical repeated ESM from the retrospective experiences) and a random intercept (the individual), but no predictors were entered since the interested lay in the deviations of the outcome from 0. To test potential group differences, we combined the data of the three study groups and added the variable “study group” (MDD, SP, and controls) as a fixed effect to the model used for hypothesis one. The MeG for physical activity was assessed using a paired ttest by comparing the ESM scores with retrospectively recalled scores.

**Research Question 2.2. Do clinical and non-clinical populations differ with regard to their PB frequencies?** To test differences of MDD, SP and controls in their PB a GLMM was analyzed (manuscript two). The three groups and time course were entered to the model as fixed

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effects to statistically predict PB (fixed intercept). By-subject variability was entered in the model as a random intercept.

**Research Question 3. Does closeness to the helper, and feeling of choice impacts the relation between PB and well-being?** To analyze whether well-being is increased when PB is provided to a close individual and done by choice several LMMs were conducted. Well-being was included as outcome and either PB to a close or to a distant individual, or feeling of choice as a fixed effect to statistically predict well-being. Further, By-subject variability was entered in this first model as a random intercept and PB was entered as a random slope.

## Results

### Benefits or costs from PB?

**Research Question 1. Are PB and well-being related to each other in several populations?** Results indicated that on a time concurrent level PB is beneficial for clinical and non-clinical individuals. PB is related to higher well-being ( $\beta = 0.01$ ,  $SE = 0.004$ ,  $p = 0.01$ ), and this relation did not differ between clinical and non-clinical groups. Neither did individuals in the MDD group ( $\beta = -0.001$ ,  $SE = 0.01$ ,  $p = 0.93$ ), nor in the SP group differ from individuals in the control group ( $\beta = 0.01$ ,  $SE = 0.01$ ,  $p = 0.64$ ), with respect to the relation between PB and wellbeing. For couples no relation between PB and well-being was shown ( $\beta = 0.35$ ,  $SE = 0.58$ ,  $p = 0.58$ ). Furthermore, the opposite relation between well-being statistically predicting PB was also significant within MDD, SP and controls ( $OR = 1.63$ ,  $p = 0.01$ ). When looking at the duration of this bi-directional link between PB and well-being for this later population, using time lagged LMM and GLMM, results show no time lasting relation. Neither did PB predict well-being 3 hours later ( $\beta = 0.006$ ,  $SE = 0.005$ ,  $p = 0.25$ ), nor did well-being predict PB 3 hours later ( $OR = 0.97$ ,  $p = 0.89$ ). Again, those results did not differ for clinical and non-clinical individuals (MDD vs control:  $OR = 0.96$ ,  $p = 0.93$ ; SP vs control:  $OR = 1.53$ ,  $p = 0.51$ ).

### Which factors might influence the outcomes of PB?



**Research Question 2.1. Do clinical and non-clinical population differ with regard to their MeG?** Results for the MeGs showed significant differences between clinical and nonclinical populations. Specifically, results indicated differences with respect to the experience that was most salient to each group (e.g., MDD group – sadness; SP group – social anxiety; CG group – happiness). The MeG of sadness, which was reported in both clinical and non-clinical groups, was significantly higher for individuals in the MDD group ( $\beta = 10.06, p < 0.001, 95\% \text{ CI } [6.4313.30]$ ) compared to individuals in the control group. The MeG for physical activity was comparable for individuals in the MDD, SP and Control group, all three groups retrospectively underestimated it. More differentiated results were shown for the experiences of social anxiety and happiness. Only the two clinical groups (MDD and SP) showed a MeG, represented by a retrospective overestimation for the experience of social anxiety. The MeG was hereby significantly bigger for individuals in the MDD ( $\beta = 11.33, p < 0.001, 95\% \text{ CI } [7.86– 14.91]$ ) and SP group ( $\beta = 13.12, p < 0.001, 95\% \text{ CI } [8.42–17.84]$ ), compared to individuals in the control group. In contrast, a MeG for the experience of happiness was only present for individuals in the control and SP group (represented by a retrospective overestimation). In line with these results, only individuals in the MDD group significantly differed from individuals in the control group for the experience of happiness ( $\beta = -5.58, p < 0.001, 95\% \text{ CI } [-8.40 – -2.49]$ ).

**Research Question 2.2. Do clinical and non-clinical populations differ with regard to their PB frequencies?** Results of the GLMM showed that individuals in the MDD, SP, or control group engage to similar extents in PB in everyday life meaningful social interactions. On average, individuals in the control group reported PB in 19.30% of their meaningful social interactions, individuals in the MDD 21.58%, and individuals in the SP group 20.14%. The slightly higher percentages for the MDD and SP did not differ significantly from the control group (MDD vs control:  $OR = 1.15, p = 0.31$ ; SP vs Control:  $OR = 1.06, p = 0.77$ ).

**Research Question 3. Does closeness to the helper, and feeling of choice impacts the relation between PB and well-being.** Within couples, results of the LMMs show a significant

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positive relation between PB provided to a close individual and well-being ( $\beta = 3.29$ ,  $SE = 0.98$ ,  $p < 0.001$ ), and a negative relationship between PB provided to distant individuals and well-being ( $\beta = -4.68$ ,  $SE = 1.117$ ,  $p < 0.01$ ). Furthermore, results showed a significant positive relation between feeling that one acts prosocially by free choice and well-being, and a significant negative relation between feeling to be obligated to act prosocially and well-being ( $\beta = -0.07$ ,  $SE = 0.01$ ,  $p < 0.001$ ).

## Discussion

PB are natural and purposeful behaviors (Penner et al., 2005). Acting prosocially has been shown to be beneficial for the actor (Thoits & Hewitt, 2001; von Bonsdorff & Rantanen, 2010). However, other studies found costs associated with PB (Fredman et al., 2010; Pavalko & Woodbury, 2000). Most studies have research design limitations (Brown & Brown, 2015), e.g. using retrospective measures of PB, potentially introducing a memory bias, which might explain the contradicting study results. Furthermore, several variables and different populations might influence the outcome of PB (e.g. closeness between actor and receiver of PB, and feeling of choice of the PB provided). This dissertation extends previous literature by 1) the analysis of the relation between PB and well-being using ESM, 2) comparing this relation in several populations (clinical, non-clinical, and couples), and 3) the analysis of closeness and feeling of choice that potentially influence the relation between PB and well-being.

## Benefits or costs from PB?

Overall, the results from the three manuscripts suggest a positive relation between PB and well-being, independent of whether they are diagnosed with MDD or SP or not. This result is in line with previous studies that found benefits from PB (Gruenewald et al., 2012; Nelson et al., 2016; Piferi & Lawler, 2006; Thoits & Hewitt, 2001). However, this finding did not last over 3 hours (manuscript two) and could not be replicated in couples (manuscript three).

### **Which factors might influence the outcomes of PB?**

A variable that might explain previous contradicting findings on the outcome of PB are MeGs. Results of the first manuscript underline that studies that assess behaviors and emotions with retrospective assessments increase the chance of MeGs. MeGs seem to be general to all individuals, but those biases seem to be further increased for behaviors or emotions that are salient to the population (e.g., MDD group – sadness; SP group – social anxiety; CG group – happiness). This might explain previously reported discrepancies in the literature. As previous studies that assessed PB with retrospective measurements probably included population specific MeGs. However, as PB within this dissertation was assessed using ESM, the results cannot be attributed to MeGs. An explanation for the contradicting results of the second and third manuscript, showing once a positive relation between PB and well-being and once reporting no relation, could be related the context in which PB was assessed within those two manuscripts. Within the second manuscript PB was specifically assessed within meaningful social interactions, whereas PB within the third manuscript was assessed in every situation that participants defined as a PB. As shown by the results in the third manuscript, acting prosocially towards a close individual was related to higher levels of well-being. As such, acting prosocially within the context of a close relationship or within meaningful interaction could potentially increase wellbeing, whereas acting prosocially within non-meaningful interactions might not directly relate to higher well-being. To clarify this hypothesis future studies should replicate this finding using ESM.

Another variable that seems to influence the relation between PB and well-being is the feeling of choice to act prosocially. Results showed that the feeling of choice is positively related with well-being, whereas feeling obligated to act prosocially is negatively related to well-being. This result is in line with previous studies and the self-determination theory (Weinstein & Ryan, 2010), which showed that humans need to feel in control of one's actions.

## **Strengths and Limitations**

Some limitations of this dissertation should be mentioned. Although assessing the MeG and PB using ESM reduces the risk of memory biases (especially MeGs), participants were asked to retrospectively recall their experiences within the past 3 hours. Nevertheless, the time lapse between the experience and its recollection is short, and therefore drastically reduces the probability of memory biases. Furthermore, answering the same questions several times a day during a week could potentially lead to a reactivity effect. Regarding the MeG, reactivity would potentially lead to a better retrospective recollection of the experiences, due to higher awareness of the different experiences during the ESM week. Consequently, if a reactivity effect was present it can be assumed that the MeG was underestimated. Another limitation consists in the assessment of PB. First, participants did not report what their PB exactly consisted of. Second, the conceptualization of PB was different within the second and the third manuscript. Once, focusing specifically on helping behavior and once assessing a broader range of PBs. Third, we did not assess the MeG specifically for PB. It can be assumed that a MeG is also present for PBs, but further studies should test this. A further limitation consists in the possibility of reciprocal causation, commonly referred to as the chicken and the egg cliché. As well-being and PB have been both assessed at each time point during the smartphone assessment it can not be concluded that PB causes well-being or vice versa. However, compared to other study designs, such as cross-sectional designs, time lagged LMM represents a better attempt to capture causality.

These limitations notwithstanding, this dissertation analyzes the relation between PB and well-being using ESM. Using this methodology, we were able to measure behaviors, experiences, and emotions in everyday life with a reduced risk of memory biases while considering fluctuations over time. Furthermore, analyzing MeG and PB in several populations (clinical, nonclinical, and couples) enabled us to get a more generalizable image of those two variables. To our knowledge, this is the first study that compared the MeG and PB in clinical and non-clinical

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populations, and included several factors that might potentially influence the relation between PB and well-being in one study.

### **Outlook**

Increasing our understanding of when PB is beneficial, and whether indeed PB increases well-being and not vis versa should further be researched. Furthermore, if future studies do find a causality of PB increasing well-being, preventions and therapy programs should be developed that increase well-being through increasing PB. First indications show that the effects on wellbeing are stronger when focusing on increasing PB compared to increasing self-focused actions or self-kindness (Nelson et al. 2016). Furthermore, increasing PB is potentially not only beneficial for the actor, but also for their daily environment (Chancellor, Margolis, & Lyubomirsky, 2016), which could potentially increase well-being in the general population.

### **Conclusion**

This dissertation gives an indication of when, how and for whom PB is beneficial. PB seems to be a promising variable to increase well-being, at least in meaningful interactions or close relationships, and when choosing to behave prosocially. Additionally, this dissertation underlines the importance of using measurements that reduce the MeG. Further studies should replicate these findings and investigate whether and under which conditions PB leads to higher well-being, and how to increase well-being through programs and therapies.

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**Appendix A (Manuscript 1)**

**General or Specific? The Memory-Experience Gap for individuals diagnosed with a major depressive disorder or a social phobia diagnosis, and individuals without such diagnoses.**

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### **Abstract**

Psychological treatment and assessment necessarily rely on patients' recall. Yet several empirical studies have documented a gap between memory and real-life experience (i.e., memory–experience gap; MeG). We investigated and compared the MeG of sadness, social anxiety, happiness, and physical activity for participants diagnosed with a major depressive disorder (MDD), a social phobia (SP), and participants without such diagnoses (CG).

The study included 118 participants diagnosed with a MDD, 47 with a SP, and 119 CG. Using event-sampling methods (ESM), participants were asked via smartphone to report their experiences throughout a week and then to recall those again retrospectively at the end of the study week.

Results indicate significant differences in the MeG with respect to the experience that was salient to them (e.g., MDD group – sadness; SP group – social anxiety; CG group – happiness). Furthermore, all groups showed a MeG for physical activity and, the results indicate significant group differences in the magnitude of the MeGs.

This study demonstrated the presence of a MeG in individuals in a MDD, SP, and CG group and in positive and negative affective experiences. Differential patterns across the samples contribute to a better understanding of this gap and its implications.

*Keywords: Memory–Experience Gap, Event Sampling Methodology, Major Depressive Disorder, Social Phobia*

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General or Specific? The Memory-Experience Gap for individuals diagnosed with a major depressive disorder or a social phobia diagnosis, and individuals without such diagnosis.

Our memory is not a perfect representation of the past, and recalling experiences is often biased. The difference between a person's in vivo experience and retrospective evaluation of that same experience has been referred to as the memory–experience gap (MeG; Miron-Shatz, Stone, & Kahneman, 2009). Clarifying the nature and prevalence of this gap is crucial to accurately interpret retrospectively recalled clinical and scientific data. Previous studies have focused either on part of the general populations *or* on individuals with a mental diagnosis separately when assessing the MeG. But comparing these two populations is crucial to gaining more knowledge about the specificity (the MeG is only present for a distinct population) or generalizability (the MeG exists across different populations) of the MeG.

Previous research on memory biases suggest on the one hand that some memory biases permeate human cognitive processes. According to this view, human beings 'are prone to overestimate how much they understand about the world and to underestimate the role of chance in events' (p. 17, Kahneman, 2011). Therefore, one might conclude that memory biases are a general phenomenon. However, on the other hand, studies have also reported population-specific biases. For example, participants with a diagnosis of a major depressive disorder (MDD) have been shown to be more likely to falsely recall negative words during memory tests compared to participants in a control group (Joormann, Teachman, & Gotlib, 2009). Cognitive biases have furthermore been reported in individuals with symptoms of social phobia (SP), especially for threatening stimuli. During a visual-probe task, individuals diagnosed with SP showed slower reaction times when angry faces were displayed than participants in the control group (Mogg, Philippot, & Bradley, 2004), leading to a bias towards social threat cues. Furthermore, some

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research suggests that some memory biases are present across all individuals (general), but are larger for specific populations (specific). For example, it has been shown that all individuals tend to better remember negative than positive events (Ganzach & Yaor, 2019; Kreitler & Kreitler, 1968). Additionally, recollection of negative affect has been shown to be influenced by negative emotional peaks (high negative emotional peaks are linked with higher retrospective recall of negative affect; Ganzach & Yaor, 2019), while the retrospective recollection of positive affect is more affected by the end affect (retrospection of positive affect is overestimated when the last affect was also positive; Ganzach & Yaor, 2019). As such in line with previous studies, one might expect that all individuals show a higher MeG for negative affect, represented by a overestimation, compared to positive affect (Ganzach & Yaor, 2019; Miron-Shatz et al., 2009). Further, some individuals – for example individuals with symptoms of depression – will have an even higher MeG for negative affect compared to others, because they report higher negative daily affect (higher negative peaks) and more unpleasant events (Bylsma, Taylor-clift, & Rottenberg, 2011). However, to our knowledge the MeG for different experiences has not been compared for individuals with depression or anxiety and individuals without a mood or anxiety disorder, therefore it remains unclear whether indeed the MeG (i.e. the end product of these memory biases) itself is general or observable only in some individuals with certain memories or both.

Previous studies have tested the presence of a MeG for patients using diagnostic-specific stimuli, such as pain, panic attacks, binge episodes in eating disorders, tobacco consumption and obsessive-compulsive symptomatology, and most, but not all, found a MeG. For example, individuals meeting the threshold or subthreshold for an eating disorder and individuals with a diagnosis of a chronic pain disorder retrospectively recalled more pain and binge episodes than

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were collected through event-contingent and time-prompt electronic diaries (Stein & Corte, 2003; Stone, Broderick, Shiffman, & Schwartz, 2004). Patients with panic disorders and agoraphobia also retrospectively overestimated panic frequency before treatment when compared to a self-monitored paper and pencil diaries (De Beurs, Lange, & Van Dyck, 1992; Margraf, Taylor, Ehlers, Roth, & Agras, 1987). Another study by Shiffman et al., (1997) identified a MeG (overestimation) for tobacco consumption in individuals smoking who intended to quit smoking using an event sampling methodology (ESM) with a palm size computer. On average, participants in this study retrospectively overestimated the number of cigarettes they consumed during smoking lapses as well as their negative effect, suggesting that the MeG applies for at least this observable experience and population. Interestingly, one study examining the MeG for patients with obsessive-compulsive disorder could not confirm a MeG (Gloster et al., 2008). Participants showed an accurate recollection of diagnostically specific experiences in this population. This accuracy may be due to the specific characteristics of the obsessive-compulsive disorder population or because this study uses time-stamped via smartphone assessed event-sampling methodology (ESM).

Other studies also suggest the presence of a MeG in participants not selected for mental disorders. A study by Tadic, Braam, VanVliet, and Veenhoven, (2013), for example, showed an MeG by presenting a discrepancy between the retrospective recall of happiness and the in vivo reported level of happiness in adolescents from the general population. The MeG thus consisted in a retrospective overestimation of the levels of happiness. Miron-Shatz and colleagues (2009) provided another example of the MeG for happiness. In this study, female participants retrospectively felt happier and friendlier compared to their levels of happiness reported within specific experiences. The study by Miron-Shatz and colleagues (2009) furthermore underlined the

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presence of a MeG for feelings of anger and tension (referred to as unpleasant experiences). Using the day-reconstruction method, experiences of anger and tension were retrospectively overestimated by the participants, and the MeG was found to be larger for unpleasant than pleasant experiences.

Summarizing, studies have found a MeG, usually in the direction of overestimation, for symptom-specific experiences for patients with diagnosis and more generalized emotions for individuals of the general population or individuals not selected for mental disorders. However, as studies have not directly compared the MeG in individuals with and without diagnosis with the same stimuli, the question of whether a MeG is a general phenomenon, a specific phenomenon, or a combination thereof remains unclear. Due to overall human memory biases, one might expect that a MeG exists for all experiences and all populations. However, due to population-specific biases and population characteristics, (e.g. slower reaction times when angry faces are displayed in individuals with a diagnosis of SP), the magnitude of MeG could potentially be larger for some specific experiences in specific populations. Furthermore, most studies that have reported a MeG used paper-and-pencil diaries without a time-stamp function. Participants have been shown to miss-schedule the recording of their experiences within a paper diaries, as they allow the participants to complete the assessments at a later time (Davidson, Anestis, & Gutierrez, 2017). Overall, using retrospectively assessed methods is prone to recollection biases itself (Trull & Ebner-Priemer, 2013), because individuals are asked to recall a past event, and are not asked to report what happened in their close present. Some have used the day reconstruction method to reduce error and bias. Day reconstruction measure has been shown to indeed reproduce valid information of daily affect (Dockray et al., 2010). However, assessing the MeG using ESM and specifically via cellular phones or smartphones has previously been



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recommended (Gloster et al., 2008; Miron-Shatz et al., 2009; Trull & Ebner-Priemer, 2013), as the assessment is even closer to the real time of the experience. The use of smartphone in the general population is increasing, it includes the advantages of palm size computer and permits, with the technological advances (sending messages, apps) a more flexible way of collecting data (Davidson et al., 2017).

This study extends the literature on the MeG by examining this gap using time-stamped ESM for individuals diagnosed with MDD or SP and for individuals without such diagnosis with respect to experiences of sadness, social anxiety, happiness, and physical activity. We hypothesized that a MeG is present in all three groups (MDD, SP, and control) for experiences of sadness, social anxiety, happiness, and physical activity (hypothesis one). We further hypothesized that participants in the control group would differ with respect to the size of the MeG from participants in the MDD and in the SP group (hypothesis two). Specifically, we expect that for sadness and social anxiety the MeG would be larger for individuals in the MDD and SP group compared to participants in the control group.

## **Methods**

### **Participants**

The sample consisted of 290 individuals: participants were diagnosed with either SP or MDD, or they were in the control group that had neither SP or MDD. Eight participants in the control group met criteria for a primary diagnosis of either cannabis abuse, specific phobia, panic disorder without agoraphobia, obsessive compulsive disorder or insomnia. The MDD and the SP groups had some overlap of diagnoses at lower severity levels. 31.92% of the individuals in the MDD group had a comorbid diagnosis of social phobia and 23.73% of the individuals in the SP group had a comorbid depression diagnosis. Detailed description of co-morbidities can be

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viewed within supplementary material. That is, group assignment was made based on the primary diagnosis, but co-morbidity of diagnoses at a lower severity level was allowed. Our goal was to recruit a sample representative of clinical reality and therefore generalizable sample; as such allowed commodities with lower severity levels as opposed to recruiting a highly selective and clinically atypical group consisting only of mono-diagnostic groups. It was further our assumption that if this did affect the results, it was against the direction of our hypotheses because groups without comorbidity would artificially inflate differences between the groups.

Patients were recruited from treatment centers (university clinics and cooperating local practitioners) in Switzerland and Germany. Participants in the control group were recruited through local advertisements (flyers were distributed in local stores and the study was advertise via an online blackboard). Participation for the study occurred independent of therapy. Six participants reported on less than 50% of the ESM assessments and where therefore excluded from the study. The final sample size consisted of 118 participants in the MDD, 47 in the SP, and 119 in the control group. The sample was 67% female. The average age was 32 years ( $SD = 11.52$ , range 18–63). The three groups were matched for age and sex. In order to guarantee that the three groups had similar mean age and gender distribution, we specified the age and sex of participants to be recruited in the control group to match the general age brackets of participants in the MDD and SP groups. Overall, participants responded to 92% of the prompted ESM assessments, for a total of  $N = 10979$  assessments. Of these, 51 were only partially completed. Leaving,  $N = 10928$  assessments (92%) that were fully completed. Further demographic information such as employment status, years of education and number of diagnosis can be viewed in table 1. The sample size is adequately powered for the hypothesis (Gloster et al., 2017) and was specifically designed to test the generalizability.

[Table 1 near here]

## **Procedure**

The data is part of a larger longitudinal study and was approved by the Ethikkommission Nordwest- und Zentralschweiz (EKNZ – 236-12). Detailed descriptions of the study design and procedure are presented elsewhere (Gloster et al., 2017). At baseline, participants gave informed consent, answered demographic questions, filled out questionnaires on symptoms, emotion regulation, and well-being, and completed a diagnostic interview. To assure the reliability of the diagnoses, each patients' diagnoses was discussed with a senior clinical psychologist. Depending on the diagnostic status of each participant (DSM-IV MDD diagnosis, DSM-IV SP diagnosis or no DSM-IV diagnosis for MDD or SP), was then assigned to one of the three study groups: MDD, SP, or control. One week after the baseline assessment, participants received an ESM training, that is, they were given the smartphone they were going to use for the next 7 days and were trained how to fill out questionnaires on it. Between the ESM training (day 8) and the last appointment (day 15), participants completed questionnaires on the smartphone contingent on an audible signal every 3 hours during each day (six prompts during each day). Items for sadness, social anxiety, happiness, and physical activity were asked 5 times a day. The last questionnaire was assessed shortly before bed-time of each participant (e.g. 8 a.m., 11 a.m., 2 p.m., 5 p.m., 8 p.m., and 11 p.m.). The first morning questionnaire only included few items to reduce burden of the participant. The participants returned the device at the last appointment. During the post assessment, participants were asked to recall experiences they had recorded on the smartphone during the previous seven days. The participants also filled out further questionnaires. All assessments were conducted in German.

## **Assessments**

### **Diagnostic**

At baseline, trained PhD students and master's students performed the Axis I of the Structured Clinical Interview (SCID-I) to determine the diagnostic status of each participant.

The SCID-I is a semi-structured clinical interview that is designed to determine DSM-IV conform diagnoses (Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997). The SCID-I is a reliable and valid instrument for assessing Axis I diagnosis (First & Gibbon, 2004). Lobbestael, Leurgans, and Arntz (2011) show moderate to excellent inter-rater with a mean Kappa of 0.71.

Furthermore, participants were asked at baseline to fill out the Beck Depressive Inventory (BDI-II; Hautzinger, Keller, & Kühner, 2009), the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998), the Perceived Stress Scale (PSS; Cohen & Janicki-Deverts, 2012) and the short form of the Mental Health Continuum (MHC-SF; Lamers, Westerhof, Bohlmeijer, Klooster, & Keyes, 2010).

The BDI-II (Hautzinger et al., 2009) contains 21 items designed to assess depressive symptomatology and suicidal ideation over the preceding two weeks. One-week test-retest reliability for the BDI-II is .93 and internal consistency is .92 among outpatients (Beck, Steer, & Brown, 1996).

The 20 items version of the SIAS (Mattick & Clarke, 1998) was used to measure social anxiety, specifically participants reaction to situations that involve social interactions. The instrument scales from 0 “not at all” to 4 “extremely”. The been shown to be a valid instrument (Brown et al., 1997).

The PSS (Cohen & Janicki-Deverts, 2012) is most widely used to measure stress scale from 0 “never” to 4 “very often”. High scores on the items represent high level of perceived

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stress. The instrument show good validity and reliability. We used the 10 items version. The PSS shows high reliability and validity (Roberti, Harrington, & Storch, 2006).

Finally, the MHC-SF (Lamers et al., 2010) is a reliable (Keyes, 2005) and valid (Keyes, 2006; Lamers et al., 2010) measurement for well-being. Overall, 14 items measure emotional well-being (happy, interested in life, and satisfied), psychological well-being (self-acceptance, environmental mastery, positive relations with others, personal growth, autonomy, purpose in life) and social well-being (social contribution, social integration, social actualization, social acceptance, social coherence). Scaling go from 0 “never” to 5 “every day”. High score represents high level of well-being.

### **Memory–experience gap**

To measure the MeG, we assessed the level of sadness, social anxiety, happiness, and physical activity of each participant several times during the ESM week and once again during the post assessment. We chose to measure the experiences of sadness and social anxiety because they represent experiences that are characteristic for individuals with a MDD and a SP diagnosis. We further chose the experience of happiness as a specific affect and the experience of physical activity as an observable behavior since those experiences are present across all individuals. The items asking for the level of, sadness, social anxiety, happiness, and physical activity originated from previous ESM studies (Brown, Strauman, Barrantes-Vidal, Silvia, & Kwapil, 2011; Gloster et al., 2008; Kashdan & Steger, 2006), validated questionnaires (Beck et al., 1996; Bundesamt für Statistik, 2013), and self-developed items. Items were modified to query for sadness, social anxiety, happiness and physical activity since the last assessment (ESM items) or were queried for the previous week (retrospective items). Based on the BDI-II (Hautzinger et al., 2009) and previous ESM studies sadness (Brown et al., 2011) was assessed with the wording “did you feel

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sad”. Based on a previous ESM study from (Kashdan & Steger, 2006) social anxiety was assessed with the wording “were you worried about what people think about you?”. The item happiness was adapted from a previous study from Brown and colleagues (2011). The item was formulated; “were you happy?”. Finally, physical activity was adapted by a previous publication from a swiss health survey (Bundesamt für Statistik, 2013) with the wording “engaged in a physical activity leading to sweating for at least 30 minutes?”. The items sadness, social anxiety and happiness ranged from 0 “never” to 100 “always”, and the item physical activity was dichotomous “yes”/ “no” for the ESM item and from 0-7 days for the retrospective item. Specifically, ESM items began with the words: ‘Since the last beep, what percentage of time did you . . .’; whereas retrospective items (after the ESM week) began with the words: ‘On average during the last 7 days, what percentage of time did you . . .’ (table 2).

[Table 2 near here]

### Statistical Analysis

All analyses were conducted using the statistical program R, version 3.3.2 (2016/10/31). To analyze our two hypotheses, linear mixed models were conducted, which are well suited for repeated assessment measurements with interdependent observations of data nested within individuals. The outcome was the respective MeG, which was obtained by subtracting the repeatedly assessed and hence time-varying ESM based characteristics from the retrospectively assessed characteristics, which was assessed once. Thus, the resulting difference score was also time-varying an estimate of the experienced MeG at each point in time.

For hypothesis one, we ran a separate model for each study group and outcome. The model contained only a fixed and a random intercept, but no predictors since we were interested deviations of the outcome from 0. The fixed intercept thereby tested the presence of a MeG for a

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specific study group. To test whether the magnitude of the MeGs differed among the three study groups (hypothesis 2) we combined the data of the three study groups and added study group as a fixed effect to the model used for hypothesis one. The analysis of the outcome physical activity differs from the other tested experiences, in that participants were retrospectively asked to report the number of days in a week that they exercised while in the ESM assessment participants were asked whether they had engaged in a physical activity. Therefore, this outcome was only available on a weekly basis (and not several times a day as for the other outcomes) and varied between 0 and 7. We consequently used a paired t-test to analyze this outcome with the two methods of assessing the weekly number of physical activity (via ESM or retrospectively) as factor.

### **Results**

During the ESM assessment (in vivo experience), across all participants reported that they were sad, socially anxious and happy, 28%, 27% and 50% of the time, respectively. They were further engaged in physical activity on 2.77 days during the ESM week (self-reported via ESM). Table 3 gives further information on the characteristics of the three groups, separately for these smartphone and retrospective assessments.

[Table 3 near here]

### **Hypothesis 1**

Figure 1 and figure 2 graphically depict the results of the first hypothesis. That is, they show the presence of a MeG for participants in the MDD, SP, and control groups with respect to experiences of sadness, social anxiety, happiness, and physical activity.

#### **Sadness and Social anxiety**

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First, linear mixed models showed that participants in the control group significantly overestimated their levels of sadness (by 2.55,  $p < 0.01$ , 95% CI [0.65–4.45]) when recalling them retrospectively in comparison to measuring it with ESM. With respect to social anxiety, participants in the control group did not show any indication of a MeG (0.19 difference between the retrospective recall and ESM,  $p = 0.81$ , 95 % CI [-1.43 – 1.81]).).

Participants in the MDD group strongly overestimated both their levels of sadness (by 12.52,  $p < 0.001$ , 95% CI [9.60– 15.44]), and their level of social anxiety (by 11.58,  $p < 0.001$ , 95 % CI [8.45–14.71]) when recalling them retrospectively. Similarly, participants in the SP group also overestimated both their levels of sadness (by 6.05,  $p < 0.001$ , 95% CI [2.53 – 9.58]), and even more so of social anxiety (by 13.31,  $p < 0.001$ , 95% CI [10.59–16.44]) when recalling them retrospectively.

### **Happiness**

Participants in the control group overestimated their levels of happiness by 6.55 when recalling it retrospectively in comparison to measuring it in vivo ( $p < 0.001$ , 95% CI [4.55–8.55]). In contrast, participants in the MDD more or less *accurately* recalled their happiness (difference 1.10 compared to levels of happiness measured in vivo,  $p = 0.31$ , 95% CI [-1.02–3.22]). Similar to participants in the control group, though to a lesser degree, participants in the SP group overestimated their levels of happiness by 4.50 when recalling it retrospectively in comparison to their in vivo reports ( $p = 0.01$ , 95% CI [0.98–8.02]).

### **Physical Activity**

Regarding physical activity, participants in all three groups retrospectively underestimated the number of days they had engaged in physical activity (figure 2). Participants in the control group underestimated the days they had engaged in a physical activity by -0.34 ( $p = 0.013$ , 95% CI [-



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0.77–0.21]), as well as participants in the MDD group by -0.27 ( $p = 0.03$ , 95% CI [-0.61 – 0.12]), and participants in the SP group by -0.37 ( $p = 0.03$ , 95% CI [-0.84 – -0.16]).

### **Hypothesis 2**

The size of the MeG differed among participants in the control group and participants in the MDD group across most experienced characteristics. The MeG (represented by a overestimation) was hereby significantly higher for sadness (by 10.06,  $p < 0.001$ , 95% CI [6.43– 13.30]) ) and social anxiety (by 11.33,  $p < 0.001$ , 95% CI [7.86– 14.91]) in participants in the MDD group and significantly lower for participants in the MDD group for happiness (by -5.58,  $p < 0.001$ , 95% CI [-8.40 – -2.49]). Participants in the control group and participants in the MDD group did not differ in their MeG for the experience of physical activity.

The MeG (represented by a overestimation) for the experience of social anxiety also differed significantly between participants in the control group and participants in the SP group (by 13.12,  $p < 0.001$ , 95% CI [8.42–17.84]), with a higher gap for participants in the SP group. However, for all other experienced characteristics (sadness, happiness and physical activity) participants in the control group and participants in the SP group showed no differences in their MeGs.

[Figure 1 and 2 near here]

## **Discussion**

### **Discussion of the results**

This study examined whether participants' experiences and memories (MeG) differed both within and between participants in an MDD, participants in an SP, and participants in a control group. Overall, our findings suggest that the MeG (usually an overestimation) exists across participants in the MDD, participants in the SP, and participants in the control group

alike, but that the size of the recall bias (how much is overestimated/underestimated) depends on the study groups.

Our first hypothesis—that a MeG exists for participants in the MDD, SP, and control groups—was generally confirmed for the internal experiences of sadness, social anxiety, happiness, as well as the discrete experience of physical activity. We found a MeG for symptom specific experiences, specifically, an overestimation of sadness and social anxiety in individuals with symptoms of MDD or SP, respectively. Each group showed the largest overestimation with respect to the experience that is salient to that group – interestingly, this effect was not limited to negative affect, but encompasses positive affect (in participants in the control group), too. These results are in line with previous studies that have shown that patients with a diagnosis of chronic pain and patients with a diagnosis of eating disorders overestimated the intensity and frequency of their symptom specific experiences (Stein & Corte, 2003; Stone et al., 2004). Furthermore, this result is in line with previous studies that have shown a MeG for happiness in women (Miron-Shatz et al., 2009; Tadic et al., 2013). The different amplitudes of MeGs between participants with a MDD or SP diagnosis, and without such diagnosis have previously not been described and extend our knowledge on the MeG, and suggest that the MeG occurs in stimuli that are most salient within each person's idiographic profile.

Interestingly, participants in the MDD group overestimated with a high magnitude all assessed symptom specific experiences (sadness and social anxiety), whereas participants in the SP group also overestimated both symptom specific experiences but with a clearly higher magnitude for the experience of social anxiety. Additionally, only participants in the control and in the SP group overestimated happiness. In contrast participants in the MDD group accurately recalled that they had been happy approximately a third of the time – and this was lower in

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absolute levels than both participants in the SP and participants in the control group. The present results are congruent with the tripartite model of anxiety and depression (Clark & Watson, 1991). The model described shared components between depression and anxiety that explains the high co-morbidities between those disorders. Moreover, the model also refers to disorder specific components (such as hyperarousal specific for anxiety and low positive affect specific to depression) that account for differences between the two. As such, similarities between participants diagnosed with MDD and SP diagnosis could explain the general tendency of both to overestimate sadness and social anxiety and the differences between both for the experience of happiness.

We also found a MeG for the experience of physical activity over all study groups. All groups significantly underestimated the number of days they had engaged in physical activity. This result adds to the literature because, to the best of our knowledge, the MeG for physical activity has not yet been assessed. Nevertheless, previous studies on the MeG for other observable experiences, such as tobacco consumption, have also shown a MeG (Shiffman et al., 1997).

Using this methodology, we documented that individuals with a diagnosis of MDD or SP are off by between 6 and 13 percent when they retrospectively estimate the identical information. Importantly, this estimate is probably a best-case scenario because the participants were prompted every three hours to think about these experiences. As such, these rates likely underestimate the actual MeG present when questionnaires or interviews are used without prior prompting.

Our second hypothesis, which stated that participants in the MDD, the SP and the Control group would differ from each other in the size of their MeG, was confirmed. The results indicate

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significant group differences in the magnitude of the different MeGs. The MeG (represented by an overestimation) for the experience of sadness was larger for participants in the MDD group compared to participants in the control group. In contrast, participants in the SP and participants in the Control group did not significantly differ from each other with respect to sadness. But when the MeG was analyzed for social anxiety, the MDD and SP groups had both higher MeGs (represented by an overestimation) than the participants in the control group. An opposite result could be shown for the MeG for the experience of happiness and physical activity, as such as the MeG (represented by an overestimation for happiness and an underestimation for physical activity) was larger for participants in the control group compared to participants in the MDD group. These results of the second hypothesis are in line with the previous findings from Miron-Shatz and colleagues (2009), and Ganzach and Yaor (2019). The MeG was indeed larger for negative affect compared to positive affect, this however was specific to individuals with depression or social anxiety. Which speaks for the fact that individuals with a diagnosis of depression or SP have specific characteristics or experiences that further increase a MeG for negative experiences (e.g. specific population biases or higher negative peaks). Furthermore, it seems that the MeG is indeed a general phenomenon, as all our study groups reported discrepancies, but that the presence of the gap and the size of it is related to specific populations (MDD group, SP group, or control group).

### **Theoretical contributions**

To our knowledge this study is the first to show population specific differences in the MeG. A consistent and overall theme of our results is the tendency of participants in the control group to report a higher magnitude in the MeG (reported as an overestimation) in happiness compared to participants in the MDD and SP group. The MeG in participants with a MDD or SP

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diagnoses was nearly the opposite pattern of the MeG in participants in the control group. It has previously been claimed that individuals without a diagnosis of depression have cognitive biases that enable them to see themselves and their environment in a positive light (Alloy & Abramson, 1979). This self-attribution bias (e.g., making internal attributions for successes and external attributions for failures; Alloy & Abramson, 1981) has been described as an adaptive strategy that maintains a sense of well-being (Ackermann & DeRubeis, 1991). Overestimating happiness could therefore also have a protective function for mental disorders. Overestimating sadness and social anxiety could hypothetically be a result of diagnostically specific attentional biases toward mood-congruent experiences in individuals with symptoms of depression (Mathews & MacLeod, 2005) and toward threatening experiences in individuals with symptoms of social anxiety (Mogg et al., 2004). A crucial question that further studies need to address is whether these cognitive biases explain the different size of the MeG and, further, if an overestimation of happiness is a protective factor for the development of mental disorders whereas an overestimation of diagnostically specific experiences is a risk factor for the development and maintenance of mental disorder, in addition to other cognitive and behavioral factors.

### **Practical Implication**

These findings are of use for clinical practice and research. Next to other validated assessment and treatment components, researchers and clinicians should consider adding ESM more often in therapy and research since our results clearly show that information assessed through retrospective recall is biased. As such clinicians could for example show patients the discrepancy between their weekly assessed symptoms, and their retrospectively remembered symptoms. As a result, this could promote in therapy cognitive reconstruction and increase the patient's motivation for improving their daily mindfulness to reduce the memory-experience

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gap. Methods of cognitive reconstruction and mindfulness have previously been shown to reduce symptoms and increase individual's well-being (Clark & Beck, 2010; Hofmann, Sawyer, Witt, & Oh, 2010). Another practical implication could be to strengthen positive view as a potential protective factor of psychopathologies. Previous findings show that more happiness is related to less psychopathological symptoms (Garaigordobil, 2015), and is related to more success in several life domains, such as work, relationships and physical health (Lyubomirsky, King, & Diener, 2005). Hypothetically, it is not only the level of happiness that is a protective factor against psychopathologies, but also the presence of a memory-experience gap of happiness (specifically the overestimation of happiness) that acts as a protective factor. Future studies should therefore include the memory-experience gap of happiness, next to other well-known protective factors (e.g. coping strategies, social support; Roohafza et al., 2014)), as a predictor for psychopathologies to test this hypothesis.

### **Limitations**

There are some limitations to this study that should be mentioned. First, although ESM is designed to collect real-time data, we used it to measure retrospectively recollected experiences from the previous 3 hours. Nevertheless, ESM permits data collection in vivo that is close to real time and thus drastically reduces the factors that make later recall biased. Furthermore, answering questions several times a day on a smartphone could pose a reactivity threat if it leads to participants recalling their weekly experiences better. If this is the case, we assume that if anything, this resulted in an underestimation of the MeG in this study. Second, further variable could also confound with our results and explain a MeG.

## **Conclusion**

These limitations notwithstanding, concluding this study extends the literature on ESM and the MeG by showing initial evidence of the memory-experience gap as a function of the interaction between diagnosis and targeted experience. We suggest that the differences of the MeG in patients with a diagnosis of MDD or SP and individuals without such diagnosis could contribute to the explanation of differences in the status of their psychological health. A MeG in happiness and positive experiences could contribute to psychological health, and a MeG in diagnostically specific experiences could contribute to the maintenance of symptoms. Further research is needed to test the function of the MeG as an amplifier for health or psychopathologies.

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**Disclosure statement**

The authors reported no potential conflict of interest.



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**Tables**

Table 1

*Demographic information of the sample*

|                                 | <i>Control</i>     | <i>MDD</i>         | <i>SP</i>         |
|---------------------------------|--------------------|--------------------|-------------------|
| <i>Years of education in %</i>  |                    |                    |                   |
| <i>8-10</i>                     | <i>12.0</i>        | <i>21.1</i>        | <i>9.3</i>        |
| <i>11-13</i>                    | <i>53.0</i>        | <i>51.4</i>        | <i>67.4</i>       |
| <i>14+</i>                      | <i>35.0</i>        | <i>27.5</i>        | <i>23.3</i>       |
| <i>Employment status</i>        |                    |                    |                   |
| <i>% Employed</i>               | <i>57.1</i>        | <i>52.5</i>        | <i>38.3</i>       |
| <i>% Unemployed</i>             | <i>39.5</i>        | <i>46.6</i>        | <i>61.7</i>       |
| <i>Number of diagnoses in %</i> |                    |                    |                   |
| <i>0</i>                        | <i>90.8</i>        | <i>0.0</i>         | <i>0.0</i>        |
| <i>1</i>                        | <i>6.7</i>         | <i>45.8</i>        | <i>44.7</i>       |
| <i>2</i>                        | <i>1.7</i>         | <i>29.7</i>        | <i>27.6</i>       |
| <i>3+</i>                       | <i>0.8</i>         | <i>24.6</i>        | <i>27.7</i>       |
| <i>BDI Mean and (SD)</i>        |                    |                    |                   |
|                                 | <i>27.0 (8.2)</i>  | <i>17.0 (11.7)</i> | <i>3.0 (7.1)</i>  |
| <i>SIAS Mean and (SD)</i>       |                    |                    |                   |
|                                 | <i>31.0 (14.4)</i> | <i>44.0 (12.5)</i> | <i>10.0 (7.3)</i> |
| <i>PSS Mean and (SD)</i>        |                    |                    |                   |
|                                 | <i>27.0 (5.3)</i>  | <i>25.0 (6.0)</i>  | <i>13.0 (7.2)</i> |

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|                                   |             |             |             |
|-----------------------------------|-------------|-------------|-------------|
| <hr/> MHC-E <i>Mean and (SD)</i>  |             |             |             |
|                                   | 1.67 (0.96) | 2.67 (1.12) | 4.00 (0.92) |
| <hr/> MHC-S <i>Mean and (SD)</i>  |             |             |             |
|                                   | 1.20 (0.94) | 1.40 (0.96) | 2.60 (1.14) |
| <hr/> MHC- P <i>Mean and (SD)</i> |             |             |             |
|                                   | 1.75 (0.98) | 2.17 (1.19) | 3.50 (0.96) |
| <hr/>                             |             |             |             |

*Note.* Control = participants without a diagnosis of a major depressive disorder or social phobia, MDD = participants diagnosed with a major depressive disorder, SP = participants diagnosed with a social phobia; BDI - II = Beck Depression Inventory; SIAS = Social Interaction Anxiety Scale; PSS = Perceived Stress Scale; MHC - E, -S, -P = Mental Health Continuum – Emotional, Social, and Psychological subscales, SD = standard deviation.



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Table 2

*Formulation of the event sampling method and retrospective items*

| Type of experience | ESM items   | Retrospective items  | Range   |
|--------------------|---|--|---|
| Sadness            | Since the last beep, what percentage of the time did you feel sad?                                    | On average during the last 7 days, what percentage of the time did you feel sad?                                   | ESM & retrospective items: from 0 (never) to 100 always |
| Social anxiety     | Since the last beep, what percentages of the time were you worried about what people think about you? | On average during the last 7 days, what percentage of the time were you worried about what people think about you? | ESM & retrospective items: from 0 (never) to 100 always |
| Happiness          | Since the last beep, what percentage of the time were you happy?                                      | On average during the last 7 days, what percentage of the time were you happy?                                     | ESM & retrospective items: from 0 (never) to 100 always |

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|                      |  |  |   |
|----------------------|--|--|---|
| Physical<br>activity | Since the last beep,<br>have you engaged in<br>a physical activity<br>leading to sweating<br>for at least 30<br>minutes? | How many days did<br>you pursue a<br>physical activity<br>leading to sweating<br>for at least 30<br>minutes? | ESM item:<br>dichotomy<br>scaling<br>(Yes/No),<br>Retrospective<br>items: from 0 to<br>7 days |
|----------------------|--|--|---|

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*Note.* ESM = items assessed via an event sampling method (smartphone).

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Table 3

*Means and Standard Deviations of sadness, social anxiety and happiness and the Sum of the days individuals have engaged in a physical activity assessed through event sampling methods and retrospectively.*

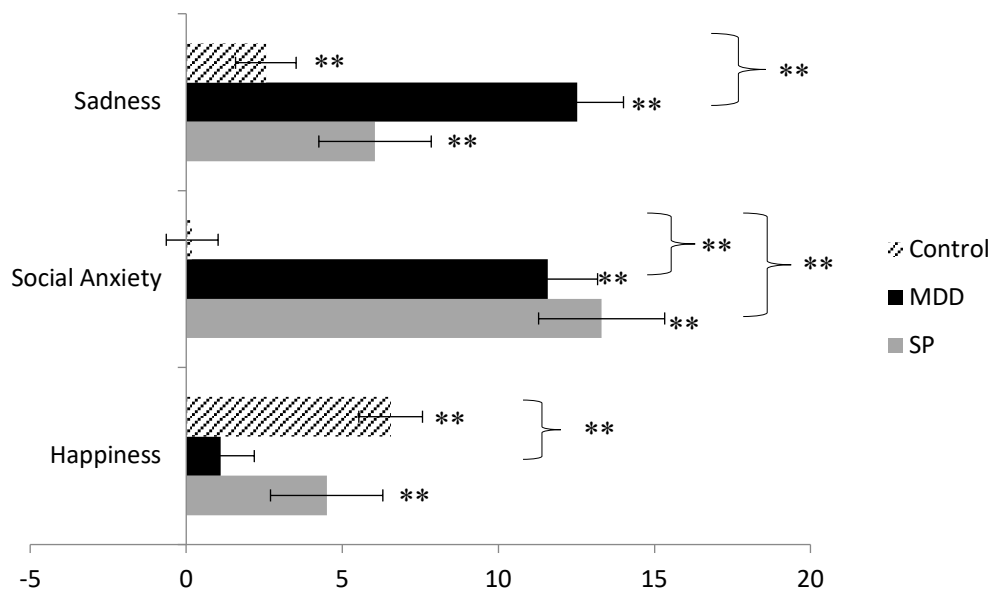
|                   |         | ESM           | Retrospective recall |
|-------------------|---------|---------------|----------------------|
| Sadness           |         |               |                      |
| (Range: 0-100)    | Control | 9.95 (13.11)  | 12.24 (16.50)        |
|                   | MDD     | 31.29 (20.37) | 43.90 (27.96)        |
|                   | SP      | 22.64 (16.65) | 28.02 (19.20)        |
| Social anxiety    |         |               |                      |
| (Range: 0-100)    | Control | 8.68 (9.45)   | 8.74 (11.31)         |
|                   | MDD     | 28.05 (19.82) | 39.61 (29.44)        |
|                   | SP      | 28.46 (18.53) | 41.12 (22.25)        |
| Happiness         |         |               |                      |
| (Range: 0-100)    | Control | 63.73 (23.95) | 70.21 (26.43)        |
|                   | MDD     | 31.90 (19.48) | 32.69 (22.85)        |
|                   | SP      | 35.11 (20.81) | 39.54 (24.14)        |
| Physical activity |         |               |                      |
| (Range: 0-7 days) | Control | 3.67 (2.22)   | 3.25 (2.16)          |
|                   | MDD     | 2.69 (2.22)   | 2.33 (2.19)          |
|                   | SP      | 3.00 (2.20)   | 2.63 (2.10)          |

*Note.* This table represents retrospective values and values assessed through an event sampling method (smartphone) for each group and each experience. The differences between retrospective recall and event sampling method represent approximately the memory-experience gap (MeG) calculated via GLLM. MeG scores can differ in

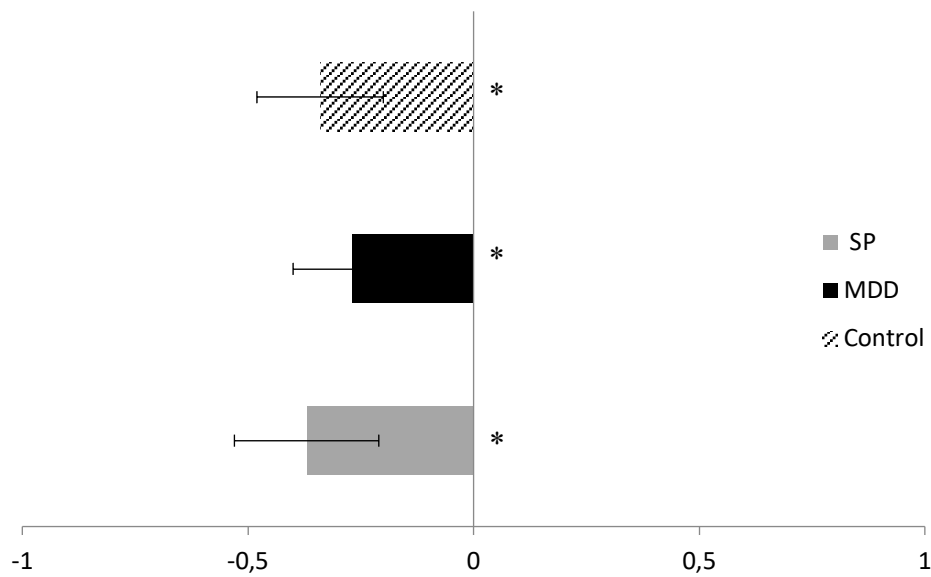
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the GLLM model, because GLLM model represent calculate estimated values. ESM = values assessed via an event sampling method (smartphone), Control = participants without a diagnosis of a major depressive disorder or social phobia, MDD = participants diagnosed with a major depressive disorder, SP = participants diagnosed with a social phobia.

## Figures



*Figure. 1* Group-specific memory-experience gap (MeG) for the experiences of happiness, social anxiety, and sadness. A MeG of 0 represents an accurate retrospective recall of the experience. Negative scores represent retrospective underestimations, and positive scores retrospective overestimations. Significant MeGs as well as significant between-group comparisons are coded in this figure on a  $p$  level of \*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$ . Control = participants without a diagnosis of a major depressive disorder or social phobia, MDD = participants diagnosed with a major depressive disorder, SP = participants diagnosed with a social phobia.



*Figure. 2* Group-specific MeG for physical activity. A memory-experience gap (MeG) of 0 represents an accurate retrospective recall. Significant negative MeG scores represent retrospective underestimations of the number of days of physical activity. Significant MeGs are coded in this figure on a  $p$  level of \*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$ . No significant between-group comparisons were shown for the experience of physical activity. Control = participants without a diagnosis of a major depressive disorder or social phobia, MDD = participants diagnosed with a major depressive disorder, SP = participants diagnosed with a social phobia.

## SUPPLEMENTARY MATERIAL

Table

Description of co-morbidities

| ICD-10 code | Description                                  | Control<br>(N = 119) |      | MDD<br>(N =118) |       | SP<br>(N = 47) |       |
|-------------|--|----------------------|------|-----------------|-------|----------------|-------|
|             |  | N                    | %    | N               | %     | N              | %     |
| F10.1       | Alcohol abuse                                | 0                    | 0    | 3               | 2.54  | 1              | 2.13  |
| F12.1       | Cannabis abuse                               | 0                    | 0    | 1               | 0.85  | 0              | 0     |
| F30         | Manic episode                                | 0                    | 0    | 0               | 0     | 0              | 0     |
| F30.9       | Manic episode, unspecified                   | 0                    | 0    | 1               | 0.85  | 0              | 0     |
| F32         | Major depressive disorder, single episode    | 0                    | 0    | 0               | 0     | 13             | 27.66 |
| F33         | Major depressive disorder, recurrent         | 0                    | 0    | 0               | 0     | 2              | 4.26  |
| F34.1       | Dysthymic disorder                           | 0                    | 0    | 6               | 5.09  | 2              | 4.26  |
| F40.00      | Agoraphobia, unspecified                     | 0                    | 0    | 5               | 4.24  | 2              | 4.26  |
| F40.01      | Agoraphobia with panic disorder              | 1                    | 0.84 | 3               | 2.54  | 2              | 4.26  |
| F40.1       | Social phobias                               | 0                    | 0    | 28              | 23.73 | 0              | 0     |
| F40.2       | Specific (isolated) phobias                  | 1                    | 0.84 | 9               | 7.63  | 6              | 12.77 |
| F41.0       | Panic disorder without agoraphobia           | 1                    | 0.84 | 6               | 5.09  | 1              | 2.13  |
| F41.1       | Generalized anxiety disorder                 | 0                    | 0    | 22              | 18.64 | 7              | 14.89 |
| F41.9       | Anxiety disorder, unspecified                | 0                    | 0    | 2               | 1.70  | 0              | 0     |
| F42.0       | Predominantly obsessive compulsive cognition | 0                    | 0    | 0               | 0     | 0              | 0     |
| F42.1       | Predominantly obsessive compulsive behavior  | 1                    | 0.84 | 4               | 3.39  | 1              | 2.13  |
| F42.2       | Obsessive compulsive cognition and behavior  | 2                    | 1.68 | 2               | 1.70  | 1              | 2.13  |
| F42.8       | Obsessive compulsive disorder, unspecified   | 0                    | 0    | 0               | 0     | 0              | 0     |

# GENERAL OR SPECIFIC? THE MEMORY-EXPERIENCE GAP.

|       |  |   |   |   |      |   |      |
|-------|--|---|---|---|------|---|------|
| F43.1 | Post-traumatic stress disorder (PTSD)                            | 0 | 0 | 0 | 0    | 2 | 4.26 |
| F43.2 | Adjustment disorders   | 0 | 0 | 1 | 0.85 | 0 | 0    |
| F45.2 | Hypochondriacal disorders  | 0 | 0 | 0 | 0    | 0 | 0    |
| F50.0 | Anorexia nervosa   | 0 | 0 | 0 | 0    | 0 | 0    |
| F50.1 | Atypical anorexia nervosa  | 0 | 0 | 0 | 0    | 1 | 2.13 |
| F50.2 | Bulimia nervosa  | 0 | 0 | 4 | 3.39 | 3 | 6.38 |
| F50.8 | Other eating disorders   | 0 | 0 | 3 | 2.54 | 0 | 0    |
| F50.9 | Eating disorder, unspecified                                     | 0 | 0 | 0 | 0    | 1 | 2.13 |
| F51.0 | Insomnia not due to a substance or known physiological condition | 0 | 0 | 1 | 0.85 | 0 | 0    |

*Note.* Control = participants without a diagnosis of a major depressive disorder or social phobia, MDD = participants diagnosed with a primary major depressive disorder, SP = participants diagnosed with a primary social phobia, % = percent of the participants for each group having this specific co-morbid diagnosis



**Appendix B (Manuscript 2)**

**Is helping you helping me? The assessment of helping others using event-sampling  
methodology in a clinical and a non-clinical sample.**

Marcia T. B. Rinner, Andrea H. Meyer, Jürgen Hoyer, Thorsten Mikoteit, Christian Imboden,  
Martin Hatzinger, Klaus Bader, Marcel Miché, Roselind Lieb, and Andrew T. Gloster

IS HELPING YOU HELPING ME?

IS HELPING YOU HELPING ME?

**Is helping you helping me? The assessment of helping others using event-sampling methodology in a clinical and a non-clinical sample.\***

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## Abstract

Individuals diagnosed with Major Depressive Disorder (MDD) and Social Phobia (SP) have difficulty in social interactions. It is unknown, however, whether such difficulties prevent them from helping others, thereby depriving them of the natural benefits of helping, such as receiving gratitude. Using event sampling methodology (ESM), individuals (MDD,  $n = 118$ ; SP,  $n = 47$ ; and control group,  $n = 119$ ) responded to questions about the frequency of helping, in total at 5333 time point, and reported about the relation between helping others and well-being.

Contrary to our hypothesis, individuals in the MDD, SP, and control group didn't differ in their helping frequency. Results did show, however, a bi-directional relation between helping and well-being, such that helping is related to well-being and well-being to helping.

Understanding the complex relation of helping others and well-being and how this might be used during therapy and prevention programs are discussed.

**Is helping you helping me? The assessment of helping others using eventsampling methodology in a clinical and a non-clinical sample.**

The existence of a natural tendency of prosocial behavior in humans is widely accepted (Post, 2005). Human beings are capable of caring deeply for individuals and helping others in need. Helping is not only beneficial for the individual in need, but can also be beneficial for the helper. Indeed, several studies have documented that giving help is associated with better mental health (Schwartz, Meisenhelder, & Reed, 2003). For example, spending money to help other people or doing nice things for others has been shown to increase positive affect of the helper (Aknin et al., 2010; Nelson, Layous, Cole, & Lyubomirsky, 2016). Furthermore, giving help is associated with higher intrinsic value, such as self-esteem (Piferi & Lawler, 2006), self-worth (Gruenewald, Liao, & Seeman, 2012), and increased life satisfaction (Thoits & Hewitt, 2001). The link between helping and well-being has been shown in a broad age range of adults. For example, a review comparing volunteering in older adults concluded that volunteering predicts better health and life satisfaction (von Bonsdorff & Rantanen, 2010). In addition to increasing psychological well-being, helping behavior could also reduce negative outcomes such as symptoms of depression and social anxiety. Compared to individuals who don't volunteer, volunteers show lower level of social anxiety (Handy & Cnaan, 2007), and in older adults, volunteers show lower levels of depression (Musick & Wilson, 2003). A number of hypotheses have been posited as to why helping is beneficial. For example, many acts of helping necessitate the use of personal skills and personal resources in which individual take pride. This in return leads to an increase feeling of purpose in life (Musick & Wilson. 2003). In general, "Making the world a better place" has been claimed to be a value for many individuals (Musick & Wilson, 2003), and valued behavior has been shown to reduce suffering. Furthermore, helping others improves social contacts (Musick & Wilson, 2003), which increases well-being and in return reduces negative mood and psychopathologies (Golden et al., 2009; Steptoe, Shankar, Demakakos, &

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Wardle, 2013). Helping can also be seen as a form of behavioral activation. As emphasized by the reinforcement theory and its modern variants, behavioral activation increases positive reinforcement, which decreases symptoms of depression (Carvalho & Hopko, 2011; Mazzucchelli, Robert, & Clare, 2009). As such, helping may contribute to the reduction of psychopathologies and increases well-being, because it's a behavioral activation that is positively reinforced.

While many studies report beneficial effects of helping, several other studies show no effects or even costs from helping others (Pavalko & Woodbury, 2000; Schulz & Sherwood, 2008). For example, a study designed to increase well-being and social ties of participants within a foster grandparent program found no expected gains in emotional health from the program (Rook & Sorkin, 2003). Other studies showed burden from helping in form of increased psychological distress for care givers (Hirst, 2005), and higher stress level for care givers compared to non-care givers (Fredman, Cauley, Hochberg, Ensrud, & Doros, 2010). High level of volunteering has also been shown to have aversive effect in elderly adults (Windsor, Anstey, & Rodgers, 2008). It has been argued that helping is costly for the individual because it is resource depleting. That is, helping consumes valuable attentional and regulatory resources, which otherwise could have been used by the helpers for himself or herself (Lanaj, Johnson, & Wang, 2016).

In sum, previous studies report both benefits and costs from helping others. It remains unclear whether helping leads to better well-being or less well-being per se. It is plausible that a couple of factors account for the discrepant results. Specific idiosyncrasies of a population (e.g. patients with symptoms of depression) and the different assessment methods used to test the effect of helping might explain why helping is sometimes related to higher well-being while other times related to less well-being.

### **Helping in different populations**

Compared to non-clinical populations, individuals with a diagnosis of Major Depressive Disorder (MDD) or Social Phobia (SP) might be deprived of the benefit of helping due to less access to positive reinforcements, as both populations are characterized by a pattern of social withdrawal and difficulties in social interactions (Beidel, Rao, Scharfstein, Wong, & Alfano, 2010; Segrin, 2000). Individuals with depression have been found to have lower social skills and communicate with their interpersonal partners with more negativity (Blumberg & Hokanson, 1983; Segrin, 2000). Also, individuals diagnosed with SP can be characterized with social skill deficits, such as difficulties starting or joining a social conversation or have increased expectations of failure in social contexts (Beidel et al., 2007). Those difficulties in social interactions might lead to less helping behavior (less reinforcement behavior), and when engaged in helping potentially deprive individuals with MDD or SP from the benefits of helping others.

From the few existing studies assessing the frequency of helping in depressive patients, discrepancies are reported. In a review from Alarcón and Forbes (2017) the authors concluded that compared to healthy controls, the frequency of prosocial behavior (here measured through behavioral tasks such as economic games) is reduced in adults with MDD. Another study however showed no differences between MDD and non-depressed controls, with respect to their behavior during another behavioral task (Gradin et al., 2016). Due to the indirect assessment of helping through behavioral tasks and the conflicting results from these two studies, it remains unclear whether MDD and SP differ in their helping frequency compared to individuals without such diagnosis. On the one hand, individuals with MDD might help others more often with the goal of relieving negative symptoms of depression (Alarcón & Forbes, 2017). On the other hand, individuals with MDD could help other less often due to a reduced ability to feel pleasure (anhedonia) and specifically the pleasure that is associated with helping others (Alarcón & Forbes, 2017). In line with this second claim,

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individuals with depression or anxiety could hypothetically also help less as a consequence of avoidant behavior and reduces positive reinforcements (Carvalho & Hopko, 2011).

Specifically, for individuals with SP, it can be expected that those individuals help others less frequently, due to an increased anxiety in the social context (Beidel et al., 2010), and increased avoidance of social context (American Psychiatric Association, 2013).

Next to the unclarity of the frequency of helping within different populations, it remains unclear whether individuals with a MDD or SP diagnosis might be deprived from the benefit of helping or due profit from it. Individuals with depression might not gain benefit from helping due to their reduced ability to feel pleasure and the lack of reinforcement, or, in contrast, they might benefit from helping because it helps relieve symptoms of depression. Some studies assessing depressive symptoms in non-clinical individuals have shown that helpers (here defined as volunteering) show lower levels of depression in older adults, but no relation between helping and depression was found in a younger populations (Musick & Wilson, 2003), suggesting that older adults who help less feel more depressed and as a consequence report lower well-being. This conclusion however cannot be generalized to a clinical population, because the study from Musick and Wilson (2003) was conducted within a non-clinical population. Regarding individuals with a diagnosis of SP, negative consequences from helping could also be expected, because helping in a social context might be anxiety provoking (Beidel et al., 2010). Those conclusions, however, remain hypothetical, as to our knowledge no study has assessed the link between helping and well-being in individuals with SP.

### **Assessment of helping**

Another explanation why some studies report benefits from helping, while others report costs might be that most previous studies have assessed helping using retrospective instruments that demand individuals to recall their behavior over long time frames, which



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were vastly different across previous studies. Due to the time lag between the event and the moment of recall, such retrospective instruments are prone to memory biases (citation removed for blinding) that might influence the recollection of the feeling involved after having helped others. Some individuals might have overestimated the benefits they got from helping, whereas others might have overestimated the cost from helping. This is underlined by a study showing that individuals report more helping behavior in recent than in distant events (McGuire, 1994), and therefore probably underestimated the frequency of helping in distant events, overestimated the frequency in recent events, or both. Surprisingly, few studies have used assessment tools known to reduce memory biases, such as event sampling methods (ESM), for assessing helping behavior. One such study using ESM to assess the immediate effect of helping concluded that helping among coworkers comes at costs, but the drained resources are replenished when helping made a positive and visible difference (Lanaj et al., 2016). However, another ESM study in the general population found a positive relation between helping and well-being, which was further increased when individuals felt less competence prior to helping (Hui & Kogan, 2018). These two ESM studies reduced retrospective recall biases, however both studies used different populations (i.e., non-clinical coworkers and individuals of the general population) and did not assess symptoms of psychopathology (e.g. depression level), which might have had accounted for the different outcomes. Studies are needed that directly compare two populations to assess whether the relation between helping and well-being differs for different populations while using methodologies such as ESM that decrease recall bias and increase the ability to understand how these actions unfold in real time as well as in real everyday life. Another advantage of using ESM to test helping behavior, is that it allows for the measurement and testing of temporal links. Precisely whether helping at time point A predicts well-being of a later time point (time point B) or vis versa. As such one could assess with ESM whether helping antecedes well-being or is a consequence of well-being. A study that assessed temporal links

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of eudaimonic behavior and well-being using ESM, did find a time effect in which eudaimonic behavior were related to greater well-being of the next day (Steger, Kashdan, & Oishi, 2008). This study did not, however, focus specifically on helping behavior, but rather on broader aspects of eudaimonic behavior, including some helping behaviors (e.g., volunteering) and other psychological variables such as expressing gratitude, or engaging in values (Steger et al., 2008). Another study that focuses on the temporal effect of helping (here defined as hours of volunteering) showed that helping significantly increased happiness and life satisfaction, and that individuals with greater well-being help more often (Thoits & Hewitt, 2001). The authors suggest that individual with high well-being have resources that enhances the likelihood of seeking out helping, which itself enhances well-being because of intrinsic and extrinsic gratifications resulting from helping (Thoits & Hewitt, 2001). Thus, well-being may be viewed as both an antecedent or a consequence of helping. Consequently, as individuals with MDD and SP have lower overall well-being compared to non-clinical individuals, they might have less resources to help others, therefore effectively help less frequently, and as a further consequence experience less often the benefits from helping. Due to methodological limitations of this study (time referents of the items and only 2 assessments points) further studies are needed that assessed the temporal link between helping and wellbeing using ESM.

Overall, previous studies illustrate the complexity of the relation between well-being and helping. As such, previous studies show benefits and costs from helping, and disagree about the frequency of helping in clinical populations compared to non-clinical populations, necessitating direct comparisons. This study aimed to extend the previous literature on helping behavior, by 1) examining helping frequency within individuals diagnosed with MDD and SP and individuals in a control group, 2) examining the relation between helping and well-being while 3) using ESM to examine the temporal link of helping and well-being.

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We first hypothesized that individuals in the MDD or SP group would differ in their relative frequency of helping compared to individuals in the control group (hypothesis 1). We further hypothesized that 2) helping and well-being are related to each other over all study groups. As it remains unclear whether helping is an antecedent to well-being or a consequence of well-being, we formulated additional hypotheses representing two different models; an antecedence model (e.g., helping predicts well-being) and a consequence model (helping is a consequence of well-being and therefore that well-being predicts helping). There is evidence for the existence of both models therefore we hypothesized that, 3.a) that helping predicts subsequent well-being in all study groups (antecedence model), and 3.b) that well-being predicts subsequent helping in all study groups (consequence model).

### **Methods**

#### **Recruitment and Procedure**

The data reported within this study is part of a larger longitudinal project (Gloster et al., 2017) which was approved by the local ethics committee (EKNZ – 236-12). Individuals within this project were recruited from three combined treatment centers (university clinics and cooperating local practitioners) in Basel and through local advertisements.

At baseline, individuals answered demographic questions; filled out questionnaires on symptoms, emotion regulation, and well-being; and completed measures of cognitive functioning. The diagnostic status of each individual was also determined at baseline through the Clinical Interview for DSM-IV Axis I Disorders (First & Gibbon, 2004; Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997). Individuals with (a) active current suicidal intent, (b) current substance dependence, (c) inadequate language level and (d) further disabilities prohibiting individuals to participate in the study were excluded. Individuals had to be between 18 and 65 years old to be included. Included individuals were then assigned and matched for age and sex to one of the three study groups: MDD, SP, or control group, depending on their primary DSM-IV diagnosis. Individuals in the MDD group had a primary

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MDD diagnosis; individuals in the SP group a primary SP diagnosis; and individuals in the control group had neither a MDD nor a SP diagnosis, but other diagnoses were permitted.

During the second assessment, individuals were instructed in a smartphone assessment (ESM training) and received the device for the daily assessments. During the following week all individuals were asked to repeatedly complete questionnaires (e.g., helping behavior and well-being) on the smartphone contingent on an audible signal every three hours during each day for a total of six times per day. The last daily questionnaire was assessed shortly before bed time. On the last day, individuals returned the device to the laboratory.

### Sample and Participants

In total, 290 individuals were included in the study. Six individuals reported on less than 50% of the ESM assessments and were excluded from the study. The final sample consisted of 284 individuals; 118 in the MDD group, 47 in the SP group and 119 in the Control group. A detailed description of demographic information can be viewed in table 1. Overall, individuals responded to 92.3% of the prompted ESM assessments, for a total of  $n = 10,979$  assessments. Of these, 51 were only partially completed, leaving,  $n = 10,928$  assessments (91.9%) that were fully completed.

“Table 1 about here”

### Assessments

All assessments were administered via ESM as follows.

**Helping.** Within a first question individuals were asked to report if they had engaged in a meaningful social interaction since the last prompt. When endorsed, individuals were asked to report if they had helped someone within their meaningful social interaction since the last prompt. Helping behavior was assessed five times a day. Helping was not assessed during the first morning questionnaire shortly after waking in order to reduce the length of the morning questionnaire and to reduce potential burden.

**Well-being.** In this study we were interested in the aspects of well-being that can potentially fluctuate over the one-week time frame that participants recorded information. Therefore, we abstracted four items from the mental health questionnaire (MHC-SF; Keyes, 2009) that represent well-being that can fluctuate during the week: happiness, satisfaction with life, endorsement of activities that helped the person grow, and feeling a sense of purpose. The exact wordings of the four items are presented in table 2. The four items were asked 5 times a day and were rated on a scale from “0” to “100”. A mean score of all 4 items represented well-being of each individual at each prompt.

“Table 2 about here”

### Statistical analysis

All analyses were conducted with the statistical program R, version 3.5.0. In a first step a mean score for well-being was computed and the normal distribution of well-being was clarified by inspecting a histogram. Well-being was approximately normally distributed and therefore met the assumption of normal distribution. Further, means and standard deviation were calculated to describe the characteristics of the sample (table 1). In a second step the hypotheses were tested using Linear Mixed-effect Models (LMM) or GLMM (General Linear Mixed-effect Model). LMM and GLMM are the method of choice for analyzing repeated measurements with interdependent observations of data nested within individuals. The fit of each model was tested based on Akaike’s Information Criterion (AIC; Singer & Willett, 2003). Random intercepts and random slopes were entered in the model when it improved the fit.

To test differences of the three study groups in their helping behavior (hypothesis 1) we used a GLMM with “helping” (absence versus presence of helping behavior since the last prompt) as binary outcome, study group and time course as fixed effects to predict helping behavior. By-subject variability was entered in the model as a random intercept. Individuals in the control group were defined as the reference group.

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Hypothesis 2 was tested using linear mixed-effect models (LMM). We tested in a first model, whether helping is related to well-being across all study groups, with well-being as outcome, helping, and time course as fixed effects, and random coefficients for intercept and time course. In a next step, the interaction effect between helping and study groups was added, to test potential differences among the three study groups with respect to the relation between helping and well-being. In a second model we tested whether well-being is related to helping by using a GLMM with well-being, and as fixed effects, plus a random intercept. To analyze potential study group differences in the relation between well-being and helping, we added the interaction effect between well-being and study group.

Hypothesis 3 tested whether helping is an antecedent or a consequence of well-being. The antecedent model (hypothesis 3a.) is equal to the first model of hypothesis 2 except that the predictor variable “helping” was assessed at the preceding time point (three hours earlier) rather than concurrently. The consequence model (hypothesis 3.b) is equal to the second model of hypothesis 2, but with time-lagged well-being instead of concurrent well-being.

## Results

### Preliminary analysis

Preliminary analysis showed that all three study groups regularly engaged in meaningful social interactions during the ESM week. Individuals in the control group reported engaging in a meaningful social interaction in 81.2% of the assessed time points, individuals in the MDD group in 80.2%, and individuals in the SP group in 79.6%. Overall, individuals reported about their helping behavior within meaningful social interactions 5333 times. A preliminary LMM was conducted to compare the well-being of the three study groups. The LMM model included study groups as a fixed effect to predict well-being, while controlling for individual variability. Results show that there are significant group differences in levels of well-being ( $F(2, 281.06) = 70.34, p < 0.001$ ). On average, individuals within the MDD ( $\beta = -0.27, SE = 0.02, p < 0.001$ ) and SP ( $\beta = -0.22, SE = 0.03, p < 0.001$ ) group

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reported less well-being than individuals in the control group (Figure 1). The well-being score of individuals in the MDD group on average was 27 points lower (on a 0 -100 scale) and 22 points lower for individuals in the SP group compared to individuals in the control group (Figure 1).

“Figure 1 about here”

**Hypothesis. Individuals in the MDD or SP group will differ in their relative frequency of helping compared to individuals in the control group.**

Results of the first model indicated that individuals in the control group helped other people on average in 19.30% of their meaningful interactions. Similar percentages were shown for the MDD and SP group, where they endorsed helping during 21.58% (MDD group) and 20.14% (SP group) of their meaningful social interaction (Figure 2). Neither did individuals in the MDD group ( $OR = 1.15, p = 0.31$ ), nor did individuals in the SP group ( $OR = 1.06, p = 0.77$ ) reported significantly more helping behavior compared to individuals in the control group. Furthermore, helping behavior slightly increased during the time course of the ESM week ( $OR = 1.01, p = 0.04$ ).

“Figure 2 about here”

**Hypothesis 2. Helping and well-being are related to each other over all study groups**

Consistent with our second hypothesis (first model), results indicated that helping is related to higher well-being over all study groups ( $\beta = 0.01, SE = 0.004, p = 0.01$ ). There was no interaction effect between helping and study groups, i.e. neither did individuals in the MDD group ( $\beta = -0.001, SE = 0.01, p = 0.93$ ), nor in the SP group differ from individuals in the control group ( $\beta = 0.01, SE = 0.01, p = 0.64$ ), with respect to the relation between helping and well-being.

Further, consistent with our second hypothesis well-being was related to helping (second model) across all groups ( $OR = 1.63, p = 0.01$ ). There was no interaction effect between wellbeing and study groups, i.e. neither did individuals in the MDD group ( $OR = 0.96, p =$

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0.93), nor in the SP group differ from individuals in the control group ( $OR = 1.53$ ,  $p = 0.51$ ), with respect to the relation between well-being and helping.

### **Hypothesis 3.a (antecedence model). Helping predicts subsequent well-being in all groups.**

Helping did not predict subsequent well-being three hours later ( $\beta = 0.006$ ,  $SE = 0.005$ ,  $p = 0.25$ ). Also, there was no interaction effect between helping and study groups, i.e. the effect of helping on subsequent well-being did not differ from individuals in the control group, neither for individuals in the MDD group ( $\beta = 0.002$ ,  $SE = 0.01$ ,  $p = 0.84$ ), nor for individuals in the SP group ( $\beta = -0.01$ ,  $SE = 0.02$ ,  $p = 0.51$ ).

### **Hypothesis 3.b (consequence model). Well-being predicts subsequent helping in all study groups**

Well-being did not predict helping at a later time point (3 hours later;  $OR = 0.97$ ,  $p = 0.89$ ). Again, there was no interaction effect between well-being and study groups, i.e. the effect of well-being on subsequent helping did not differ from individuals in the control group, neither for individuals in the MDD group ( $OR = 0.96$ ,  $p = 0.93$ ), nor for individuals in the SP group ( $OR = 1.53$ ,  $p = 0.51$ ).

## **Discussion**

This study analyzed whether individuals diagnosed with MDD, SP, and individuals in a control group differ in their helping frequency, and tested the relation of and temporal sequence between helping and well-being in those individuals. Results showed that despite different overall levels of well-being between the groups, individuals in these groups did not differ in the amount of helping they engaged in. Importantly, results suggest that helping and well-being impact each other in a bi-directional manner. To our knowledge, this study was the first to compare frequency and consequences of helping within clinical *and* non-clinical populations.



## IS HELPING YOU HELPING ME?

We first hypothesized that individuals in the MDD or SP group would differ in their relative frequency of helping behavior compared to individuals in the control group. Contrary to our expectations, results showed that individuals in the MDD, SP and Control group do not differ in their helping frequency, despite the fact that they clearly have different levels of overall well-being (Figure 1 & 2). Individuals with MDD and SP help with equal frequency within personally meaningful social interactions, even though it could be expected that they show less helping behavior, due to symptoms of anhedonia, due to less resources, due to social withdrawal, reduced reinforcement, and difficulties in the social context. This result is further contrary to a previous review that concluded that adults with a MDD diagnosis show less prosocial behavior compared to healthy controls (Alarcón & Forbes, 2017). This review, however, predominantly assessed prosocial behavior with behavioral tasks, and therefore did not directly assess the frequency of self-selected helping behaviors within a natural environment. The equal frequency of helping could be explained by compensational behavior from individuals with a MDD or SP diagnosis. Individuals with MDD or SP might help other to relieve negative symptoms (Alarcón & Forbes, 2017) by helping others to feel being part of a group.

We further hypothesized that helping and well-being are related to each other over all study groups. Results show that individuals in the MDD, SP, and Control group benefit from helping others within meaningful interactions (helping is related to well-being), and that wellbeing is related to helping behavior. As such, both models for a concurrent time level were confirmed. These results are informative for the proposition that helping is beneficial or costly. These results speak for a beneficial effect of helping in individuals with MDD, SP and non-clinical individuals. Our results are in line with a study from Thoits and Hewitt (2001) that showed that superior well-being enhances the likelihood of helping, which itself enhances well-being. However, in contrast to the study from Thoits and Hewitt (2001) it seems that not the overall experienced well-being is related to helping, but the momentary

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level of wellbeing, as, compared to the control group, the MDD and SP group showed similar frequency of helping despite different overall level of well-being. One potential explanation of those results could be that helping is a reinforcement behavior that increases well-being and as a consequence reinforces the likelihood to help at a later time point. Further studies should test this by analysis the reinforcement as a mediator of helping and well-being.

Although our results support a bi-directional relation between helping and well-being, this relation seems to be restricted to a 3 hours assessment period (time between ESM prompts). That is, the effect was not detected when analyzed with a lagged analysis, which is why hypotheses 3 was rejected. This result contradicts the results from a study from Steger et al. (2008), which showed that eudaimonic behavior (e.g., volunteering, expressing gratitude, or engaging in values) predicts higher well-being the next day (Steger et al., 2008). One explanation for this contradictory finding is that different types of helping behaviors (helping vs. volunteering) influence the duration of well-being differently. Future studies should therefore consider differentiating the type of helping behavior, the length of time of assessments, and focus on helping behavior outside of eudaimonic behaviors.

Some limitation of this paper should be mentioned. The types of helping behaviors were not specified within this study. We assessed helping within personally meaningful social interactions, but did not ask individuals to specify how they helped someone. However, due to the assessment of helping through ESM and the broad definition of helping we were probably able to account for broad daily forms of helping behaviors that individuals subjectively judged to meet their personal threshold within meaningful social interactions. The error that is related to this limitation is that it likely underestimated the frequency of helping, as some task of helping might not have been recognized as helping behavior from the individuals, though this is an open empirical question. Furthermore, some evidence suggests that well-being is determined by the feelings involved in giving help (Post, 2005). When helping is overwhelming, as for example when an individual cares for a disabled person, and resources

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of the helper are depleted because of this task, helping leads to cost and reduced well-being (Post, 2005). Future studies should consider testing this. Overall, however, it seems that helping is related to well-being, and that the relation could be even higher for nonoverwhelming helping. Further studies should differentiate between overwhelming and nonoverwhelming helping and well-being using ESM. A further limitation of this study consists in the missing information about the motivation of helping, which could be very relevant for clinical therapy. Depending on the helping motivation, hypothetically, helping others could support or reduce the effectiveness of therapy. For example, individuals that feel externally motivated to help others might experience pressure from it (costs from helping), whereas individuals that are intrinsically motivated to help might feel a purpose in life (benefit from helping). However, as we did not assess the motivation of helping some individuals in this study might still have been externally motivated to help and showed high well-being. Future studies should therefore assess the motivation of helping.

These limitations notwithstanding, this study shows that the frequency of helping within meaningful social interactions in clinical and non-clinical individuals is approximately the same. Furthermore, it documented the first in vivo evidence for a time concurrent bidirectional relation of helping and well-being in a clinical and non-clinical population, and gives first information (via time lag analysis), about its duration. A strength of this study is that we have assessed helping using ESM, several times a day during one week, which reduces risk of recall bias and increases generalizability.

The positive effects of helping leads to the conclusion that further prevention and therapy programs should focus more on helping behavior to improve prevention/therapy outcomes. Studies are needed that further research the relation between helping and wellbeing, for example to clarify if feeling overwhelmed, if the motivation of helping moderated the relation between helping and well-being and if the positive effect are explained by a reinforcement effect of helping. Understanding the complex relation of helping and

wellbeing is important, because when understood, the beneficial effect could be better targeted in therapy and public health programs.

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**Tables**

Table 1

Participants demographical characteristics

|                              | Controls    | MDD          | SP           | Total         |
|------------------------------|-------------|--------------|--------------|---------------|
|                              | n = 119     | n = 118      | n = 47       | n = 284       |
| Age range                    | 18-63       | 18 -62       | 18-50        | 18-63         |
| Mean age in years (SD)       | 32.2 (12.0) | 32.7(12.0)   | 28.3(7.8)    | 31.77 (11.51) |
| Female %                     | 67.2        | 66.1         | 66.0         | 66.5          |
| Mean years of education (SD) | 14.13 (3.7) | 13.39 (3.22) | 13.13 (2.69) | 13.65 (3.37)  |

*Note.* SD = standard deviation; Control = individuals in the control group; MDD = individuals in the MDD group with a diagnosis of a major depressive disorder; SP = individuals in the SP group with a diagnosis of a social phobia.

Table 2

ESM items for state facets of well-being

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Items measuring well-being with scaling

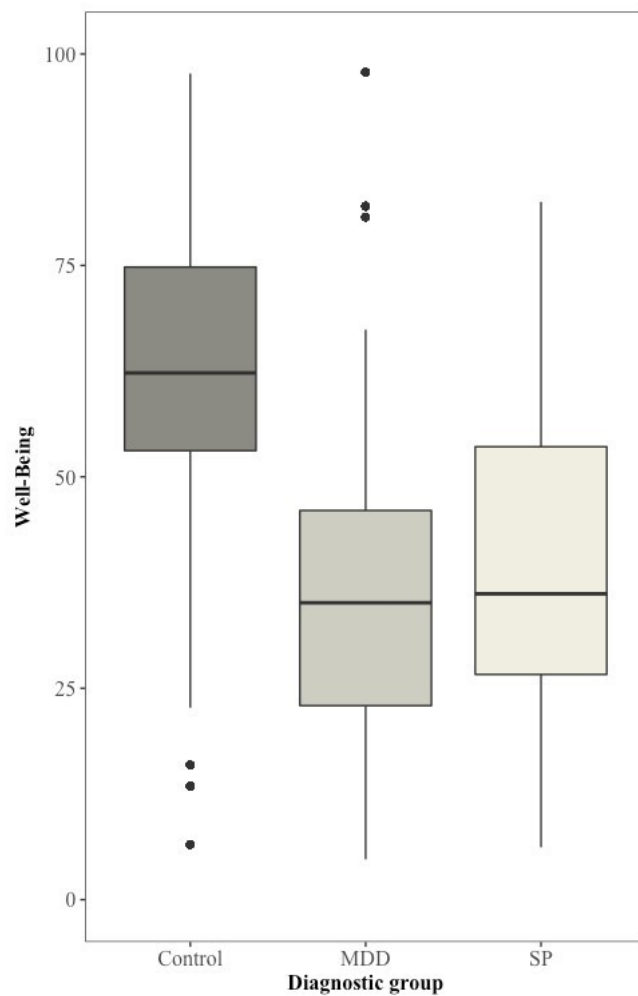
---

1. Since the last beep, what percentage of the time were you happy?  
At no time (0) – all the time (100)
2. Since the last beep, what percentage of the time were you satisfied?  
At no time (0) – all the time (100)
3. How much did you actively look for experiences to personally grow.  
Not at all (0) – Throughout (100)
4. Since the last beep, what percentage of the time did you had the feeling that your life  
had a meaning?  
Not at all (0) – all the time (100)

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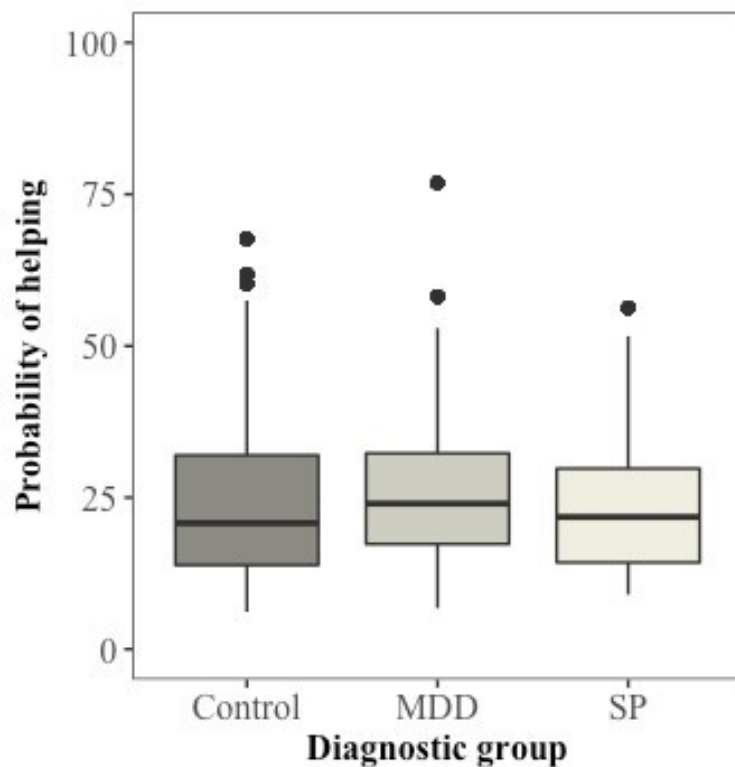
*Note.* ESM = event sampling methodology.

**Figures**



*Figure 1.* Differences in well-being depending on the diagnostic groups. Control = individuals in the control group not meeting criteria for a major depressive disorder or social phobia; MDD = individuals in the MDD group with a diagnosis of a major depressive disorder; SP = individuals in the SP group with a diagnosis of a social phobia.

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*Figure 2.* Figure 2 presents helping behavior, depending on diagnostic group. Control = individuals in the control group not meeting criteria for a major depressive disorder or social phobia; MDD = individuals in the MDD group with a diagnosis of a major depressive disorder; SP = individuals in the SP group with a diagnosis of a social phobia

## **Appendix C (Manuscript 3)**

**Giving is receiving? What influences the relation between prosocial behavior and well-being?**

Marcia T. B. Rinner, Andrea H. Meyer, and Andrew T. Gloster

**Giving is receiving? What influences the relation between prosocial behavior and well-being?**

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## Abstract

Prosocial behavior represents an evolutionary advantage for individuals. In line with this claim, several studies showed a positive relation between prosocial behavior and wellbeing. However, negative relations were also reported in the literature.

This study aimed to assess the relation between prosocial behavior and well-being using an event sampling methodology. Further, we were interested in two factors (closeness of the receiver and feeling of choice) that are believed to impact this relation. Ninety couples (180 individuals) responded during a week to questions about their helping behavior and happiness.

In total ( $n = 4839$ ) reported the frequency of their prosocial behavior. Contrary to our first hypothesis no significant relation was found between prosocial behavior and well-being. However, when prosocial behavior was provided to a close individual or given by choice, the relation between prosocial behavior and happiness was significant.

The practical implication of prosocial behavior for research and practice are discussed.

## Keywords

Prosocial behavior, well-being, happiness, choice, closeness

### **Giving is receiving? What influences the relation between prosocial behavior and well-being?**

Human beings are social beings. From an evolutionary perspective being part of a social group was important for survival and thus conferred an evolutionary advantage (Cacioppo, Hawkley, et al., 2006). Human beings are still genetically programmed to need social networks (Knafo & Plomin, 2006) and close relationships remain crucial for individual health (Uchino, 2009). This is underlined by the fact that loneliness and feelings of a lacking connections with other people (Hawkley & Cacioppo, 2010; Pikhartova, Bowling, & Victor, 2016) have been shown to increase physical and mental ailment (Richard, Rohrmann, Vandeleur, Schmid, & Eichholzer, 2017). Loneliness has also been shown to increase the likelihood of mortality (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015), the risk for cardiovascular mortality (Caspi, Harrington, Moffitt, Milne, & Poulton, 2006), and depression symptoms (Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006). Taken together, understanding how to keep and build close relations with partners, family, and friends as a source of happiness (BBC, 2005) may help prevent suffering.

### **Building and keeping close relations through prosocial behavior**

Prosocial behavior is an umbrella term that encompasses behaviors intended to benefit others (Dovidio, Piliavin, Schroeder, & Penner, A., 2006; van Rijsewijk, Dijkstra, Pattiselanno, Steglich, & Veenstra, 2016), such as helping others (e.g. opening a door for someone), volunteering (e.g. in a soup kitchen), or showing acts of kindness (e.g. comforting a friend). Prosocial behavior may be an important factor for the maintenance and development of close relationships. Children who exhibit high levels of prosocial behavior report better peer relationships than children with low levels of prosocial behavior (Clark & Ladd, 2000). Similarly, feeling of connectedness among friends is associated with prosocial behavior in adolescents (Padilla-Walker & Carlo, 2014).



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In sum, as close relationships are essential for well-being and showing prosocial behavior towards close individuals increases bonding and the maintenance of those, one may expect that prosocial behavior is related to higher well-being.

### **Prosocial behavior and well-being**

Previous studies mostly focused on the relationship between prosocial behavior and well-being between strangers (Weinstein & Ryan, 2010; Wilson, 2000), even though most prosocial behavior occurs within close relations (Amato, 1990). When prosocial behavior was assessed within strangers most studies showed a positive relation between prosocial behavior and well-being (Aknin et al., 2010; von Bonsdorff & Rantanen, 2010). Underlining the benefits of prosocial behavior, it has been shown that the level of happiness can be increased by simply asking individuals to count their acts of kindness and report them every day for a week (Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006). In contrast, studies assessing prosocial behavior within close relationships predominantly found a negative relation between prosocial behavior and well-being (Adelman, Tmanova, Delgado, Dion, & Lachs, 2014; Hirst, 2005). This difference in findings might be explained by the feeling of having the choice to act prosocially for stranger versus not having this feeling for close individuals.

### **The role of choice**

Studies finding a negative relation between prosocial behavior and well-being mainly assessed prosocial behavior within the context of care giving. Care giving represents an unequal relationship between two individuals, with the caregiver being responsible for the needs of the sick individual and his/her own stressful emotions (Pusa, Persson, & Sundin, 2012; Thomas, Morris, & Harman, 2002). One explanation for the negative effect of prosocial behavior for close relationships, such as caregiving, might be that care giving is an extreme circumstance that can involve a feeling of lack of choice and a feeling of obligation to care. Indeed, most care giver reported a feeling of obligation and an absence of reciprocity in their caregiving task (Neufeld & Harrison, 1998). According to the self-determination theory, human beings have a

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fundamental need to feel in control of one's actions (Deci & Ryan, 2000), and the lack of it might reduce well-being. Consistent with this theory, a publication on autonomous helping and well-being found that acting prosocially was only related to higher well-being when it was experienced as being a choice and not an obligation (Weinstein and Ryan, 2010). Similarly, individuals who feel that they have control, by choosing their acts of kindness, demonstrate greater improvements in well-being compared to individuals who were instructed to act kindly (Sheldon, Boehm, & Lyubomirsky, 2013).

In sum, for their own well-being, humans need to feel socially connected (Knafo & Plomin, 2006). Prosocial behavior may be a key process for the maintenance and development of close relations. Therefore, one might expect that prosocial behavior is related with high well-being and especially when given to close individuals. However, the feeling of choice seems to moderate the relation between prosocial behavior and well-being (Weinstein & Ryan, 2010). This study examined these factors by assessing prosocial behavior in participants' natural self-chosen environment across several different prosocial recipients (close relations and distant relation). First, we hypothesized that overall prosocial behavior was related to higher well-being (hypothesis one). We then were interested in two factors that are believed to impact this relation. Thus, we hypothesized that well-being is increased when prosocial behavior is provided to a close individual compared to distant individual (hypothesis two), and that well-being is increased when the prosocial individual chooses to act prosocially (hypothesis three).

## Method

### Randomization

All eligible couples were randomly allocated to one out of four study groups (figure 1). However, within this study only three groups were analyzed. Group four was not included because participants did not receive smartphone assessments. In *group one* both individuals of the couple separately received a small intervention of acceptance and commitment therapy (ACT) at pre (shortly after filling out questionnaires). During the following week both individuals of the couple were instructed to practice ACT in a paper-pencil diary and were asked to repeatedly complete questionnaires (e.g., prosocial behavior and well-being) on a smartphone when prompted every three hours on each day by an audible signal for a total of six times per day. The last assessment was administered shortly before bed time. At Post (7 days after the first assessment), both individuals returned the smartphone to the University. In *group two* only one individual of the couple, being randomly selected, received the small ACT intervention and the paper-pencil diary. The other partner that did not receive the intervention and instead engaged in a control task consisting of answering some questions about common knowledge, some vocabulary tasks and tasks about their cognitive functioning. Both individuals, however, were asked to fill out questionnaires on the smartphone device. In *group 3*, neither of the individuals within the couple received the small ACT intervention or the paper-pencil diary but both filled out questionnaires on the smartphone device.

[Figure 1 near here]

### Recruitment and Procedure

The data reported within this study is part of a larger project, which was approved by the institutional review board of the faculty of psychology of the university of Basel (001-15-2). Couples within this study were recruited through local advertisements in Basel and environment. Each couple was invited for two appointments (pre-appointment and

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postappointment) at the University and each individual filled out an online questionnaire at follow-up. Couples were invited to a first appointment (Pre) after randomization and after checking the inclusion criteria for the study during a first E-mail or phone contact.

*Time 1 (Pre).* After disclosure of the study procedure participants gave written consent, completed demographics questions, questionnaires on social interactions, questionnaires on well-being, on stress, on prosocial behaviors and on relationship quality. Individuals in groups one, two and three also received instructions on the use of the smartphone app. Furthermore, individuals randomized to receive the small ACT intervention received a small ACT intervention and were received instructions for the paper-pencil diary.

*Time 2 (post).* A week after the first assessment both participants of the couple attended a second appointment at the university site together. During this appointment participants returned the smartphone device, and filled out further questionnaires.

*Follow-up.* One week after the second assessment participants were send an e-mail with a link to an online questionnaire. This online questionnaire again included questionnaires on social interactions, questionnaires on well-being, on stress, on prosocial behaviors and on relationship quality.

### **Participants**

Eligible participants were 1) at least 18 years old, 2) currently in a heterosexual or homosexual relationship for at least 6 months, 3) in daily contact with their respective partners, 4) able to attend two appointments at the university together as a couple and 5) did not have a red-green blindness 6) had no hearing problems. Between October 2016 and April 2019 a total 494 individuals were recruited to take part in the study. 252 participants (126 couples) who fulfilled inclusion criteria at the initial contact were randomized, and were invited for a first appointment to the university. To assure that couples of all age were included in the study, randomization was conducted for two strata, hereby having one randomization strata for couples being over 30, and one for couples being under 30 years old. This study

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focuses on group one, two and three. 8 couples from group one, two and three dropped out before the pre-appointment leaving a total of 180 participants (90 couples). 10 participants (5 couples) dropped out between pre and post assessment, leaving a total of 170 participants (85 couples) completing the post assessments. Figure 1 (see manuscript 3) presents participants flow chart from the initial contact to the post assessment. With respect to the smartphone assessment 95% of the participants filled out more than 50 % of the prompts.

We excluded 6 participants that filled out less than 50% of the prompts from the analysis.

### **Assessments**

Within this study, with the exception of the demographics data, assessed at pre, all other assessments were administered within the smartphone questionnaires/ app as follows.

**Prosocial Behavior.** Prosocial behavior was assessed five times a day during the smartphone week. It was not assessed during the first morning questionnaire shortly after waking in order to reduce the length of the morning questionnaire and to reduce potential burden. Specifically, individuals were asked if they have “either helped someone, took care of someone, supported someone, or did something for someone else?”.

**Well-being.** In this study, we were interested in aspects of well-being that could potentially fluctuate over the day and week. We hereby focused on the feeling of happiness, also assessed five times a day during the smartphone week. Specifically, we asked participants five times a day, how happy they were. Measuring happiness with a single item has been shown to be a reliable, valid and viable measurement, and correlating with wellknown instruments of well-being (e.g. Satisfaction with Life Scale; Abdel-Khalek, 2006). The item happiness was extracted from the Mental Health Continuum (MHC-SF; Keyes, 2009) and adapted to the ESM format. The item was formulated as followed; “Since the last prompt, how happy were you? This item was ranged from “0” very bad to “100” very good.

**Feeling of choice.** Feeling of choice when acting prosocially was assessed five times a day during the smartphone week. When individuals acted prosocially they were asked to

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indicate on a scale from “0” (not true) to “100” (very true) how much they agreed with statements representing choice ([1] “I chose to do it”) or obligation ([2] “I did it because I felt obligated”) in response to the question (“why did you help someone?”).

**Closeness.** Closeness to the recipient was assessed with the question “Whom did you help?”. Individuals could then choose from eight options to answer this this question, representing either close individuals (partner, children, other family member, and friends), or distant individuals (working colleagues, students, and medical personal), or if none were suited specify whom they helped in open field (others).

### Analysis

Within this study we were interested in prosocial behavior in a natural environment, therefore focusing on the smartphone assessment. All analyses were conducted with the statistical program R, version 3.5.0. First, means and standard deviations were calculated to describe the study sample. Second, hypothesis one, two, and three were tested using Linear Mixed-effect Models (LMM). To test whether prosocial behavior is related to higher wellbeing (happiness) over all study groups (hypothesis one) a first LMM model was built with happiness as outcome and prosocial behavior as a fixed effect to statistically predict happiness. By-subject variability was entered in the model as a random intercept and prosocial behavior as a random slope. To analyze whether well-being (happiness) is increased when prosocial acts are provided to a close individual compared to distant individual (hypothesis two) prosocial behavior as a fixed effect was replaced within the first LMM by the closeness of the individual when acting prosocially. Finally, to analyze whether wellbeing (happiness) is increased when the actor chooses to act prosocially (hypothesis three) the prosocial behavior as a fixed effect was replaced in the first LMM by choice and in other LMM by feeling of obligation.

## Results

### Descriptive characteristics at pre

Participants of the three groups were on average 32 years old ( $SD = 12.24$ ), ranging from 18 to 75 years. The sample consisted in 51% female participants. With most couples being in a heterosexual relation (four couples being in a homosexual relation). On average participants were in a relation for 7.8 years ( $SD = 9.04$ ). The shortest relation time was six month and the longest 44 years. Twenty-five percent of the couples were married, one percent reported being in a civil union, and 74% reported neither being married nor being in a civil union. Most individuals reported as their higher degree of education having a general qualification for university entrance (30%), or an apprenticeship (20%), or a bachelor (17%). Compared to this, seven percent reported having a lower education level (no educational qualification, elementary school, or secondary school), and 19 percent reported having a higher education level (master, PhD). Additionally, seven percent reported having other degrees.

### Preliminary analysis

First preliminary analysis showed that group one, two and three were equivalent regarding age ( $F(2,177) = 0.57, p = .57$ ), length of relationship ( $F(2,175) = 0.59, p = .56$ ), and level of education ( $F(2,175) = 0.39, p = .68$ ). Further preliminary analysis showed that participants report acting prosocially 30% of the time during the smartphone week. When individuals acted prosocially, they tended to do so towards close individuals (partner, children, other family member, and friends) more frequently (68% of the instances) than more distant individuals (working colleagues, students, and medical personal; 32% of the instances). Additionally, in total, participants reported about their prosocial behavior ( $n = 4839$ ) and their happiness levels ( $n = 4791$ ), with high average levels of happiness across the week (73%).

### Hypothesis 1. Prosocial behavior is related to higher well-being.

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Results of the first LMM model showed no relation between prosocial behavior and happiness across all groups ( $SE = 0.58, p = 0.58$ ). Happiness did slightly improve by 0.35 when individuals acted prosocially, the relation however did not reach significance (figure 2).

[Figure 2 near here]

### **Hypothesis 2. Well-being is increased when prosocial behavior is provided to a close individual compared to distant individual**

Results showed a significant relation between prosocial behavior provided to close individuals and happiness ( $SE = 0.98, p < 0.001$ ). Happiness increased hereby by 3.29 points when prosocial behavior was provided to a close individual. Results also showed a significant negative relation between prosocial behavior provided to distant individuals and happiness ( $SE = 1.117, p < 0.01$ ). Happiness hereby decreased by -4.68 when prosocial behavior was provided to a distant individual.

### **Hypothesis 3. Well-being is increased when the prosocial individual chooses to act prosocially.**

Results showed a significant positive relation between the feeling of choice when acting prosocially and happiness ( $SE = 0.02, p < 0.001$ ). Happiness increased hereby by 0.06 points when prosocial behavior was provided to a close individual. Additionally, results show a negative relation between feeling of obligation to act prosocially and happiness ( $SE = 0.01, p < 0.001$ ). Happiness was hereby reduced by 0.07.

## **Discussion**

This study extends previous studies by assessing prosocial behavior within a natural day-to-day environment while assessing two factors (closeness between recipient of prosocial acts and actor, and feeling of choice). Results showed no significant relation between prosocial behavior and happiness across all prosocial acts. However, when the prosocial behavior was addressed to a close individual then prosocial behavior was significantly related to happiness.



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Additionally, when acting prosocially was done by choice then prosocial behavior was significantly related to happiness.

We first hypothesized that overall prosocial behavior is related to higher well-being. This hypothesis was not confirmed, as no significant relation between prosocial behavior and happiness was found. This result contradicts both previous studies that show significant benefits as well as those that showed costs of prosocial behavior on well-being (Adelman et al., 2014; Aknin et al., 2010; Hirst, 2005). One explanation for this could be that assessing prosocial behavior across all kinds of recipients is not ideal, as well-being increases or decreases depending on who receives prosocial acts and what feeling is involved in the act.

In line with those claims, we hypothesized that well-being is increased when prosocial acts are provided to a close individual compared to a distant individual (hypothesis 2). Indeed, results showed that behaving prosocially towards a close individual is related to a higher level of happiness than behaving prosocially towards a more distant social connection. As such, to whom prosocial behavior is given seems to play a role on the outcome. Acting prosocially towards a close individual might be beneficial because individuals feel more connected to close than distant individuals. Indeed connectedness is linked to higher well-being (Seppala, Rossomando, & Doty, 2013). Also within care giving, when controlling for the recipient level of impairments and the feeling of being “on call” for close individuals, prosocial behavior was related to positive affect (Poulin et al., 2010).

Furthermore, having the feeling to have chosen to act prosocially also played an important role in the outcome. In a third hypothesis, we hypothesized that well-being is increased when the prosocial actor chooses to act prosocially. Our results showed a significant positive relation between feeling of choice and happiness and in contrast a significant negative relation between feeling obligated to act prosocially and happiness. Those results are in line with previous studies and the self-determination theory, that underlined the importance of choice on well-being (Weinstein & Ryan, 2010).

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Some limitations of this paper should be mentioned. We did not ask individuals to describe the prosocial acts. It could be of high interests to analyze if different acts lead to different outcomes in well-being. Furthermore, asking individuals several times a day if they acted prosocially could lead to a reactivity effect.

These limitations notwithstanding, this study shows that acting prosocially towards close individuals and choosing these acts within daily life increases happiness. In line with this, first indications show that focusing on prosocial behavior may be an even more successful strategy to increase individual well-being than self-focused actions or self-kindness (Nelson et al. 2016). Further studies and therapies should therefore focus more on increasing prosocial behavior to consequently improve well-being. However, as represented by this study those programs and studies should focus on how to increase prosocial behavior towards close individuals, while having the feeling of choosing this act, as those factors seem to be even more relevant for a positive outcome of prosocial behavior.

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Figures

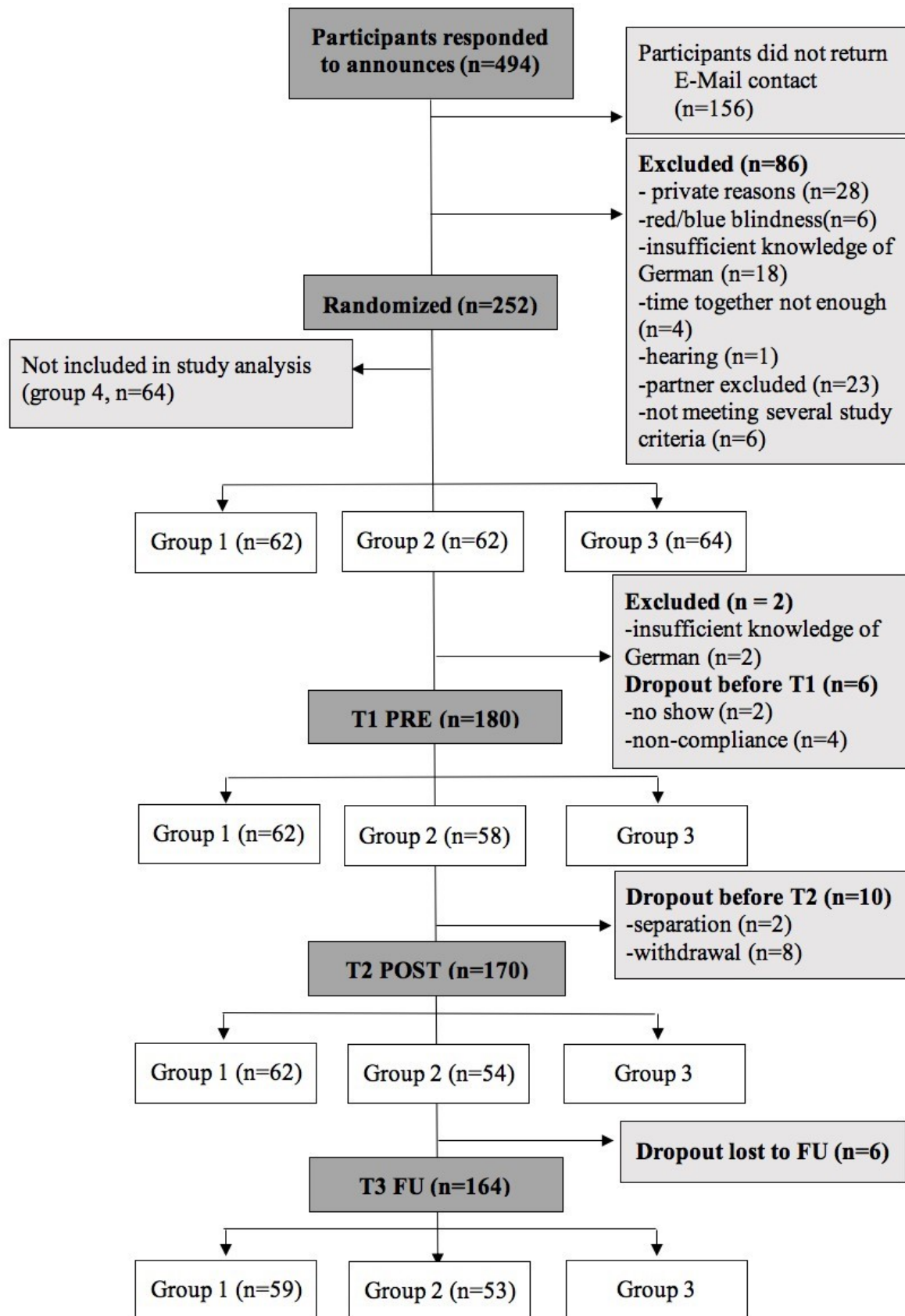
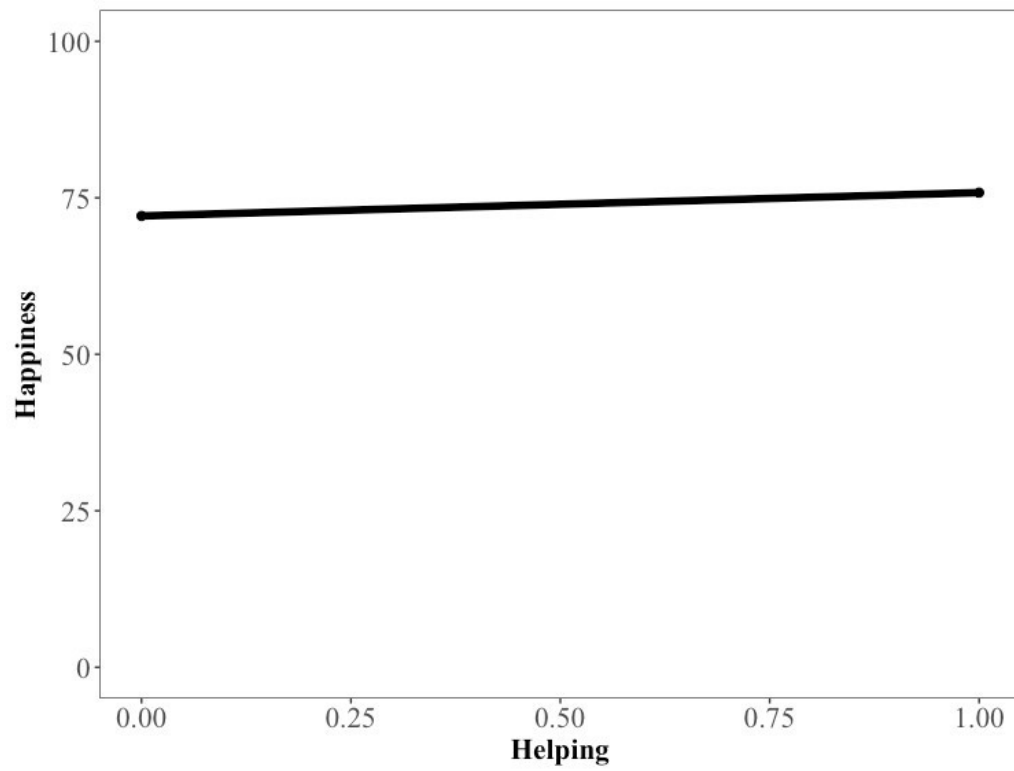


Figure 1. Participants flow chart.

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*Figure 2.* Relation between prosocial behavior and happiness (hypothesis one).



## **Appendix D (Curriculum Vitae)**